Med.

JAN 30 1928

DARTMOUTH COLLEGE

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

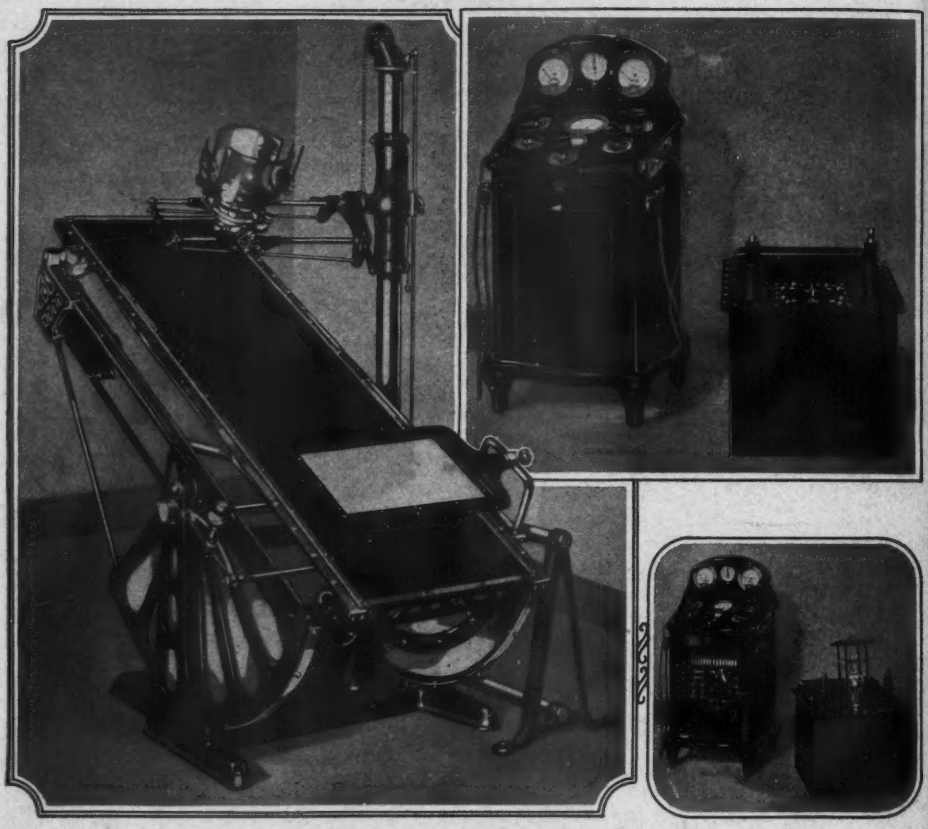
Owned and Published by
THE RADIOLOGICAL SOCIETY
OF NORTH AMERICA
As its Official Journal

JANUARY, 1928

Volume X

Number 1

PHYSIOTHERAPY
ENGELN
X-RAY



New and Interesting Engeln Equipment

THE new Engeln Motor Driven Tilt Fluoroscopic Table illustrated above with No. 6 Rail Mounted Tube Stand is commanding unusual attention and interest. This table represents a great many distinct improvements in its unusually rigid construction and wider range of Fluoroscopic vision—furnished complete with counterbalanced flat Bucky Potter Diaphragm if desired.

The photographs at the right illustrate the new 107,000 volt capacity transformer and control. The new Kenotron Tube type of rectification is incorporated into this equipment with the entire rectifying assembly oil immersed in the transformer tank. As shown in lower photograph, the rectifying tube assembly is easily accessible and the terminal panel of the control unit is complete and conveniently arranged.

The many interesting features of these and other new types of Engeln apparatus are fully explained in descriptive bulletins which will be mailed at your request.

THE ENGELN ELECTRIC COMPANY

X-Ray and Physiotherapy Equipment

SUPERIOR AVENUE AT EAST THIRTIETH STREET, CLEVELAND, OHIO

MICHIGAN
VAWII
OCT 25 1928
244406
B. P.
Med
610.5
R118
v. 10

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. X JANUARY, 1928 No. 1

THE INFLUENCE OF THE DIAPHRAGM ON THE APPLICABILITY OF THE INVERSE SQUARE LAW TO X-RAY DOSAGE

By EDITH H. QUIMBY, M.A., and WINFORD G. SARGENT, M.D.,
Department of Biophysics, Memorial Hospital, NEW YORK CITY

THE question of the applicability of the inverse square law to X-ray dosage is one which recurs at intervals. The statement has even been made that this law does not hold for certain types of X-rays (1). In this connection it is only necessary to remember that the "law" is simply a statement of a geometrical relation which must hold for any radiation emitted from a point source, and traveling unhindered in straight lines in all directions.

However, it is true that the conditions of X-ray therapy may so modify the situation that we are no longer dealing with a point source or rectilinear propagation from the original source. The focal spot of the target, particularly in broad focus tubes, is not a point, but has an appreciable area. However, at the distances used, this is negligible. The interposition of a filter in the path of a beam of rays changes the beam to some extent, by scattering and the production of secondary radiation. Moreover, the effect on the skin of the patient—the usual criterion in dosage—depends not only on the radiation from the direct beam, but also on that scattered back by the underlying tissues. In view of all these considerations, we cannot state offhand that the inverse square law is or is not applicable to X-ray dosage. It is necessary to investigate the problem experimentally.

Some years ago, experiments were made in this laboratory and the results published (2) showing that, for purposes of skin dosage in radiotherapy, the inverse square law is applicable, provided the same beam of radiation is effective at the different distances considered. That is, the area of the diaphragm must remain constant during the testing of any particular beam. Therefore the irradiated area will increase as the distance from the tube increases.

Stenstrom, working at the New York State Institute for the Study of Malignant Disease, published work showing that the law held for a constant skin area, instead of for a constant diaphragm (3). It is of practical importance to discover why this discrepancy exists. It was, therefore, decided to repeat the previous experiments with a view to deciding which, if either, of these conclusions was correct.

The same method was used as in our previous experiments, which is also substantially the method used by Stenstrom. The source of radiation was a broad focus deep therapy tube in a lead-lined box. The adjustable square lead diaphragm was fixed 42 cm. below the target, the aluminium or cop-

per filter being a few centimeters above the diaphragm. For most of the experiments X-rays generated at 140 K.V. (peak) were used. However, since the earlier work was done at 200 K.V., one series was run at that voltage. The radiation was tested unfiltered, and with a filter of 4 mm. of aluminium, and in the case of the 200 K.V., with ½ mm. of copper. The measurements were made with a small ionization chamber —1 c.c. volume—using a water phantom $35 \times 30 \times 30$ cm. In one series of tests the ionization chamber was supported in the half submerged position at the surface of the phantom, so that the effect of scattered radiation would be included. In another series it was held in a wooden clamp, with no scattering material close to it. The time of discharge of the electroscope was measured for a series of diaphragm openings, three target-ionization-chamber distances being used with each set of conditions (filtered and unfiltered radiation, with and without the water phantom). The natural leak of the electroscope was negligible. Therefore the time of discharge is inversely proportional to the intensity of the radiation. If any one intensity is taken as 100 per cent, all the others can be expressed in terms of this one. For each test we have used the intensity for the shortest distance and the largest diaphragm as 100 per cent.

Now the data for any one set of conditions (for example, unfiltered radiation, water phantom present) may be plotted as in Figure 1,[1] showing the relation of intensity to diaphragm opening, for the three distances used. In this case the distances were 93.5, 73.2 and 53.4 cm.; the respective curves are marked A, B, and C. The points on any horizontal line across the chart represent readings for the same diaphragm openings, the ionization chamber being at different distances. For instance, with a diaphragm 20×20 cm. (400 sq. cm.), when the ionization chamber was 93.5 cm. from the target the intensity was 31.2 per cent, 51.6 per cent at 73.2 cm., and 98.5 per cent at 53.4 cm.

If the inverse square law holds under these conditions (diaphragm opening constant), any such set of three readings should be in the ratio of the squares of 93.5, 73.2, and 53.4, namely, 8650, 5350, and 2848. Or, if the intensity for the shortest distance is taken as 100 per cent, those for the other

[1] These data are averages from several sets of observations.

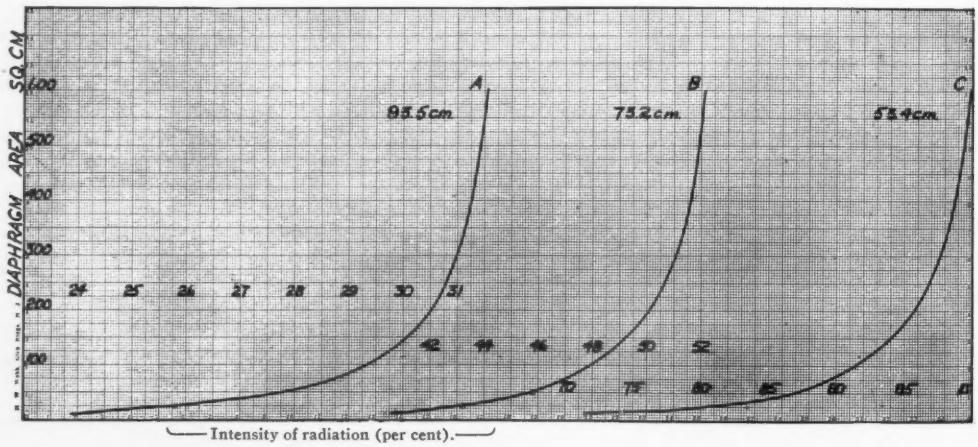


Fig. 1. Variation in intensity of radiation with variation in diaphragm opening for different target skin distances.

TABLE I

Unfiltered Radiation 140 K.V. Water Phantom Present									
Diaphragm	53.4 cm.			73.2 cm.			93.5 cm.		
Sq. Cm.	Time	Int.	Per cent	Time	Int.	Per cent	Time	Int.	Per cent
600	13.9	100	100	26.6	52.2	52.2	43.9	31.6	31.6
500	14.0	99.3	100	26.8	51.9	52.3	44.1	31.4	31.6
400	14.1	98.5	100	27.0	51.6	52.4	44.3	31.2	31.6
300	14.2	97.8	100	27.2	51.1	52.2	44.7	31.0	31.6
200	14.5	96.0	100	27.7	50.2	52.2	45.4	30.6	31.9
100	15.2	91.5	100	28.8	48.2	52.6	47.3	29.4	32.1
50	16.1	86.3	100	31.3	45.8	53.0	50.4	27.6	31.9
25	17.0	81.8	100	32.2	43.2	52.8	53.8	25.8	31.8
10	19.5	71.4	100	34.2	40.6	57.0	58.3	23.9	33.5
Average			100			53.0			32.3
Inverse Square			100			53.1			32.6
Deviation						—0.2%			—1.0%

two should be 53.1 and 32.6 per cent, respectively. Table I shows the values for several diaphragm openings, read from the curves, and the percentages for these readings.

Similar curves and tables may be made for the other sets of conditions studied. They will not be given here but their results are summarized in Table II.

This table shows the relations which exist if the diaphragm opening is kept constant for the various sets of conditions listed in the first column. The third column shows the experimental percentage decrease as the distance is increased, the fourth the theoretical. The difference is given in the last column. These two tables will be discussed a little later.

From the same experimental data curves may be obtained to show the relations existing if the diaphragm opening is varied in such a manner that the irradiated area at the ionization chamber level is kept constant for all target-chamber distances. For any diaphragm opening the area irradiated at any distance can be calculated from the relation

$$\frac{\text{diaphragm area}}{\text{irradiated area}} = \frac{(\text{target-diaphragm distance})^2}{(\text{target-ionization chamber distance})^2}$$

In this manner the areas corresponding to the diaphragms in Figure 1, for the three distances considered, have been calculated and the curves drawn in Figure 2. Now the points on any horizontal line represent readings for the same irradiated area, the ionization chamber being at different distances. If the inverse square law holds for equal irradiated areas instead of equal diaphragm openings, these numbers should be proportional to the squares of the distances. Table

TABLE II

Average Results for All Diaphragms				
Experimental conditions	Distance cm.	Per cent	Inverse square per cent	Variation per cent
140 K.V. No filter Water	53.4 73.2 93.5	100 53.0 32.3	100 53.1 32.6	 —0.2 —1.0
140 K.V. No filter No water	55.3 82.2 101.9	100 45.8 29.7	100 45.2 29.5	 +1.3 +0.7
140 K.V. Filter Water	53.4 73.2 93.5	100 53.7 33.2	100 53.1 32.6	 +1.1 +1.8
140 K.V. Filter No water	55.3 82.2 101.9	100 45.2 29.2	100 45.2 29.5	 0 —0.8
200 K.V. Filter Water	44.5 66.0 80.0	100 45.0 31.2	100 45.5 31.0	 —1.0 +0.6

III shows these values, for several different areas.

Similar data have also been obtained for the other sets of experimental conditions. They are summarized in Table IV.

We may now discuss these tables, and compare the results obtained with constant diaphragm openings and with constant irradiated areas.

Table I shows that, for a definite type of radiation (140 K.V. peak), with the water phantom backing up the ionization chamber, the percentage of radiation registered by the chamber when it is placed at different distances is almost exactly equal to that calculated according to the inverse square law. With the exception of the smallest opening, the difference between observed and theoretical values is never more than 3 per cent. For the small openings, possibilities of error are increased because of the difficulty in being sure that the tube and diaphragm are accurately centered. The average for all diaphragms differs by less than 1 per cent from the inverse square value.

Table III shows results for this same radiation when equal areas at the ionization chamber are considered, as described above. Here we see that the averages differ by several per cent from the theoretical values, while the closest individual approach has a greater divergence than the poorest value in Table I.

Therefore, from a comparison of these two tables, it seems evident that, for this

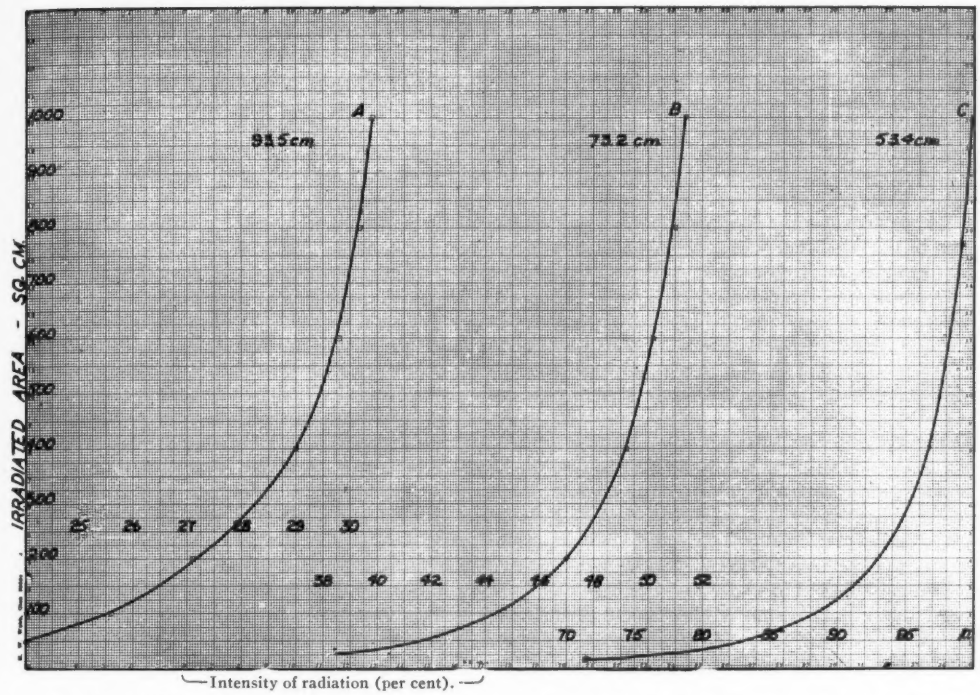


Fig. 2. Variation in intensity of radiation with variation in irradiated area for different target skin distances.

particular type of radiation, at least, the intensity of a particular beam varies according to the inverse square law, *as long as the diaphragm opening is kept constant.*

These tables both show, also, that it makes very little difference how large the diaphragm or the irradiated area, so long as it is kept constant while the comparison for different distances is being made. For square diaphragms from 10 to 600 square centimeters, and for skin areas from 25 to 1,000 square centimeters, the same ratios are obtained.[2] Therefore in presenting the data for the other types of radiation only the averages have been given; the individual variations are no greater than in Tables I and III.

[2]Smaller skin areas have not been considered because they would necessitate very small diaphragm openings, and it is difficult to be certain that in these cases the target is accurately centered. Also, the ionization chamber itself is then large compared with the area irradiated. The actual errors introduced by these two considerations may be small, but the percentage error for the small areas may be large nevertheless.

Tables II and IV present summaries of the results obtained for filtered and unfiltered radiation, with and without the water phantom, and for two voltages. In every case the results are the same. For constant diaphragm openings, the experimental results agree almost exactly with the inverse square values. For constant irradiated areas the experimental results are always considerably lower than the theoretical.

Stenstrom's work, leading to the opposite conclusion, has been mentioned earlier in this paper. The data which he publishes are given in Table V.

A water-cooled deep therapy tube was used, at 200 K.V. and 30 ma., with a filter of approximately 0.5 mm. of copper. Measurements were made with the Friedrich iontoquantimeter.

It is seen that the data presented are not extensive, and, with the exception of the

TABLE III

Unfiltered Radiation 140 K.V. Water Phantom Present									
Area	53.4 cm.			73.2 cm.			93.5 cm.		
Sq. Cm.	Time	Int.	Per cent	Time	Int.	Per cent	Time	Int.	Per cent
1000	13.9	100	100	27.1	51.4	51.4	45.8	30.4	30.4
800	14.0	99.3	100	27.3	51.0	51.4	46.1	30.2	30.4
600	14.2	97.8	100	27.7	50.2	51.3	46.7	29.8	30.5
400	14.4	96.7	100	28.3	49.2	50.9	48.0	29.0	30.0
200	14.9	93.5	100	29.6	47.0	50.4	51.4	27.1	29.0
100	15.7	88.6	100	31.4	44.3	50.0	54.5	25.6	28.9
50	16.7	83.0	100	33.8	41.2	49.7	57.5	24.0	29.4
25	19.9	75.0	100	35.5	39.0	52.0			
Average			100			50.9			29.8
Inverse Square			100			53.1			32.6
Variation						—4.2%			—9.4%

smallest field, the variation from the inverse square law is numerically about the same whether the same field or the same cone is used. Either conclusion could be drawn if we consider a discrepancy of 7 per cent negligible. The large discrepancy (23 per cent) for the small field of 2.5×2.5 cm. is probably not significant, because of the difficulty of lining up the ionization chamber and the appreciable size of the chamber in comparison to the irradiated area. In our data very small areas are omitted for this reason and because they are of no practical importance in deep therapy.

We, therefore, feel that these experiments corroborate our earlier statement, that in applying the inverse square law to X-ray skin dosage the beam of rays considered should remain constant. It should be noted, however, that, even when the same field area is considered, the error is seldom greater than 10 per cent. This variation is seldom important in therapy, where biological factors may introduce greater uncertainties.

We might expect the law to hold for unfiltered radiation when the water phantom is not used. In this case the only scattering medium is the air; the intensity at the chamber is little affected by radiation scattered by surrounding matter. But when the water phantom is used, a good deal of radiation is scattered back to the chamber. This would tend to increase the intensity. The greater the volume irradiated, up to a certain limit, the greater the amount of scattered radiation entering the ionization chamber. From this point of view it might appear more reasonable to expect the law to hold better for equal irradiated areas, since the scattering would be more nearly the same. Following this line of reasoning, it

TABLE IV

Average Results for All Irradiated Areas				
Experimental conditions	Distance cm.	Per cent	Inverse square per cent	Variation per cent
140 K.V.	53.4	100	100	
No filter	73.2	50.9	53.1	—4.5
Water	93.5	29.6	32.6	—9.2
140 K.V.	55.3	100	100	
No filter	82.2	43.8	45.2	—3.0
No water	101.9	28.6	29.5	—3.1
140 K.V.	53.4	100	100	
Filter	73.2	50.9	53.1	—4.5
Water	93.5	30.4	32.6	—6.7
140 K.V.	55.3	100	100	
Filter	82.2	42.3	45.2	—6.4
No water	101.9	26.6	29.5	—9.8
200 K.V.	44.5	100	100	
Filter	66.0	39.8	45.5	—12.5
Water	80.0	25.8	31.0	—16.8

would appear even better to consider equal irradiated volumes, as Dessauer does (4). In this case the difficulty arises as to what volume to consider. Little of the scattered radiation will traverse more than a few centimeters of water, so, after a certain depth has been reached, the increase at the surface due to scattering in the deeper layers will be small. We have made some measurements which indicate that, for the voltage here used, the scattering is increased very little, if at all, by the addition of more than 10 cm. of scattering material. Dessauer, however, considered his volume as the whole depth of his phantom. We have calculated, for the three distances used, and for three sizes of irradiated volumes, the intensities when equal volumes are irradiated, with the type of radiation considered in Tables I and III.[3] The results are shown in Table VI. In the first two columns under the heading "Experimental Intensity" the depth has been considered as 10 cm.; in the last two, the whole depth of the phantom, namely 30 cm. It is evident that it makes little difference which depth is considered. The greater approaches a little closer to the theoretical values. Comparison of this table with Tables I and III shows that these values are almost identical with those for which the irradiated areas were kept constant, and not so close to the theoretical as those for constant diaphragm openings.

The reason for this phenomenon is not obvious. For filtered radiation it might be

[3]The method of obtaining this information from the curves at hand is a matter of simple application of elementary geometrical principles. It need not be described in detail here.

TABLE V

Target-skin distance (cm.)	Field (cm.)	Time (sec.)	Variation from inverse square law	
			For same field	For same cone
80	5 × 5	232		
	10 × 10	212		
	20 × 20	187		
40	2.5 × 2.5	71	—6 per cent	+23 per cent
	5 × 5	55	—5 per cent	+ 5 per cent
	10 × 10	50	—5 per cent	+ 7 per cent

TABLE VI

Unfiltered Radiation 140 K.V. Water Phantom Present

Volume (c.c.)	Distance (cm.)	Inverse square (per cent)	Experimental Intensity			
			Volume 10 cm. deep		Volume 30 cm. deep	
			Per cent	Variation per cent	Per cent	Variation Per cent
960	53.4	100	100		100	
	73.2	53.1	50.5	— 5.0	50.7	— 4.7
	93.5	32.6	29.2	—11.6	29.4	—10.8
1920	53.4	100	100		100	
	73.2	53.1	51.5	—3.2	51.8	—2.5
	93.5	32.6	30.1	—8.2	30.5	—6.8
5800	53.4	100	100		100	
	73.2	53.1	50.7	—4.7	51.0	—4.2
	93.5	32.6	30.1	—8.2	30.4	—7.2
Average	53.4	100	100		100	
	73.2	53.1	50.9	—4.3	51.2	—3.7
	93.5	32.6	29.8	—9.4	30.1	—8.4

considered that the scattering by the filter played an important part, but the values for Tables I, III, and VI are for rays filtered only by the glass of the X-ray tube. One may attribute the observed results to the scattered and secondary radiation coming from the inner surface of the lead-lined tube holder. This is not at all point-source radiation. The larger the diaphragm opening, the more of this escapes, thus increasing the intensity at the irradiated surface. If, then, as the distance is increased, the diaphragm is closed down so as to keep the irradiated area or volume constant, less of this radiation can get out, and the intensity will be lower. The degree of lowering will be increased with greater distances, since the diaphragm opening must be smaller for these. An examination of the figures of Tables III and VI shows that this is actually the case. If filtered radiation is used, the filter will absorb a good deal of the radiation coming

from the inside of the tube holder, but will substitute for it radiation scattered by or secondary in the filter itself, the ultimate result being approximately the same.

However, an attempt to measure the amount of scattered radiation from lead was made by placing a large lead plate below the ionization chamber. With the plate just under the chamber the ionization increased about 10 per cent. When the plate was 30 or more centimeters from the chamber no increase in intensity due to this scattering could be detected. Therefore, radiations from the top of the tube holder, which is always much more than 30 cm. from the chamber, cannot be responsible for the observed effect. The influence of the position of the filter has been investigated by placing it at different distances with regard to the diaphragm and the chamber. As it is brought closer to the chamber the ionization reading increases slightly. When the filter is 16 cm. and the chamber 42 cm. below the diaphragm, respectively, the ionization reading is about 3 per cent higher than when the filter rests on the diaphragm. When the filter is just above the chamber, the reading is 10 per cent higher. This effect is too small to explain the results obtained.

In conclusion, we may say that, although we are unable to find a simple explanation of the fact, the experimental data show that, for X-rays delivered by a tube in a lead-lined tube holder, the inverse square law is obeyed when the diaphragm opening is kept fixed. This is true whether the rays are filtered or unfiltered, and whether or not a water phantom is used to back up the ionization chamber.

The authors wish to thank Dr. G. Failla for his suggestion of the problem and for his interest and suggestions during its development.

BIBLIOGRAPHY

1. Witherbee and Remer: Unfiltered and Filtered X-ray Dosage. Am. Jour. Roentgenol., 1920, VII, 485.
2. Failla and Quimby: The Economics of Dosimetry in Radiotherapy. Am. Jour. Roentgenol. and Rad. Ther., 1923, X, 944.
3. Stenstrom, W.: A Water-cooled Roentgen-ray Tube for Deep Therapy. Acta Radiologica, 1924, III, 428.
4. Dessauer and Vierheller: Strahlentherapie, 1920, XII, 655.

ROENTGEN VISUALIZATION OF THE BILE DUCTS, WITH SPECIAL REFERENCE TO INTERNAL BILIARY FISTULÆ

By JOHN L. KANTOR, M.D., Associate in Medicine, Columbia University, New York City, and

ABRAHAM E. JAFFIN, M.D., F.A.C.P., Attending Physician, City Hospital, Jersey City, N. J.

VISUALIZATION of the bile ducts with barium appears to be an extremely rare phenomenon. Apparently, no more than seven cases have been reported to date. We have had the good fortune to observe two new cases. A review of the literature from the pathological and surgical, as well as the roentgen, standpoints, leads to the conclusion that this phenomenon of spontaneous bile-duct visualization after a barium meal may ordinarily be attributed to the presence of an internal biliary fistula.

CASES PREVIOUSLY REPORTED

Case 1.—Carman (1) was actually the first to report a case of bile-duct visualization after a barium meal. This was in 1917. In his patient, the gall bladder was first filled, owing to a communication between it and the duodenum. The case was one of carcinoma of the pyloric end of the stomach which had apparently ulcerated into the gall bladder.

Case 2.—In 1921, Stephenson (2) reported the case of a man aged 56 in whom a "mulberry" gall bladder was removed in 1916 after a fourteen years' siege of "stomach trouble." The existence of jaundice was not brought out in the history. In 1920, the patient was still suffering, though the pains had changed in character, and a diagnosis of duodenal ulcer was then made. At this time, a barium meal showed the bile ducts roentgenographically. The patient was followed for one year more, when re-examination revealed the persistence of the phenomenon. During this time, no evidence of hepatitis or choledochitis developed. The explanation offered was that "following his cholecystectomy five years ago, this man has developed a dilated common duct, as has been shown to happen in many cases following a gall-bladder removal; and that this dilatation has extended within the duodenal wall, and resulted in an open stoma which offers no resistance to the backward passage of the duodenal contents."

Case 3.—In the same year, Beall and Jagoda (3) reported the third case. The patient was a woman of 42, who, after two months of intermittent epigastric pains, began to have constant pain, with vomiting, fever, and chills. There was no jaundice. About a month after the onset of the severe symptoms, a roentgen examination showed visualization of the bile ducts; the gall bladder was not filled. Laparotomy was then performed, and the gall bladder was found full of air or gas. No stones were seen. In the left upper part of the lesser peritoneal cavity, an abscess was encountered. The operative diagnosis was: Acute pancreatitis, with abscess, and insufficiency of the papilla of Vater. The explanation offered for the bile-duct visualization in this case was that the repeated vomiting had forced the barium up the ducts through an insufficient papilla. In general support of this theory, the authors published a film showing the bile ducts injected with barium in a necropsy subject. This is the first postmortem injection of which we have found a record. Incidentally, in making the injection, enough force was used to rupture the gall bladder.[1]

[1] In the following year (1922), Duval, Gatellier, and Béclère (4) made a detailed anatomical study of the topography of the normal biliary passages. They injected cadavers with bismuth paste, filling not only the biliary tract, but the urinary and pancreatic passages as well.

Case 4.—In 1922, Tenney and Patterson (5) deliberately injected the bile ducts with bismuth paste through an *external* biliary fistula. Their patient was a man in whom a cholecystectomy had been performed on account of a gangrenous gall bladder. At operation, a stone was found in the neck of the gall bladder, and there was a perforation of this organ near the cystic duct. A permanent biliary fistula resulted, and it was through this tract that the bismuth paste was introduced. Unlike the cases of spontaneous visualization, the filling of the bile duct in this case was accompanied by pain, jaundice, and fever which lasted several days. There was no communication between the fistula and the alimentary canal.

Case 5.—The first case of bile-duct visualization following an operative anastomosis with the choledochus was reported by Lenk (6) in 1925. Two years before the roentgen examination, the subject had undergone a cholecystectomy and choledochoduodenostomy. A gastro-enterostomy had also been performed. In this case as well, no infection of the bile ducts had developed.

Case 6.—In 1926, Habbe and Smith (7) published the first clear-cut report of gall-bladder and bile-duct visualization due to a spontaneous cholecystoduodenostomy in a case of chronic gall-bladder disease. The subject was a man of 70, who had complained of "stomach trouble" for about twenty-five years. In 1919, he had a severe attack, with pain and marked jaundice. Since then, the pain was less prominent. Physical examination in 1924 revealed a large, tender liver. X-ray study at that time showed that practically the entire biliary tract filled through a fistula between the duodenum and the gall bladder. Careful liver function tests proved that this organ had suffered no damage during the five years in which the fistula had presumably persisted.

Case 7.—In 1926, Fishbaugh (8) reported the case of a woman of 67, who complained of anorexia and weakness, and then began to vomit uncontrollably for six weeks before she died. Roentgen examination revealed barium visualization of the gall bladder and bile ducts, as well as delayed gastric emptying. At autopsy, a "tumor mass" was found in the region of the tail of the pancreas. No note is made of the nature of the tumor, the condition of the gall bladder, or whether a fistula was present. The past history of this case is not reported.

ORIGINAL CASE REPORTS

Case 8.—Man, aged 29, first observed in November, 1925. Discharged from the Army in 1918, on account of duodenal ulcer. In April, 1918, an operation was performed and was said to have revealed dense adhesions at the hepatic flexure, duodenum, and cecocolon, with dilatation of the duodenum. The adhesions were divided, and the appendix removed. After a few months, abdominal colics returned; and a second laparotomy, seven months later, revealed a large pendent cecum, with more adhesions in that region. These were separated, and a cecopexy was performed. Unfortunately, no note was made as to the condition of the gall bladder at either operation. Following the second operation, the patient continued to have indigestion, especially in cold weather.

In November, 1925, he began to have marked distress after meals, and vomiting of coffee-ground material. There was no melena. When he first came under our observation on November 21, 1925, he showed a large fasting stomach residue (40 ounces), with high acid values (free HCl 40, total 90). The fluid was dark, and the chemical reaction for blood was positive. The patient responded rapidly to treatment. Roentgen examination, performed December 17, 1925, revealed a markedly deformed

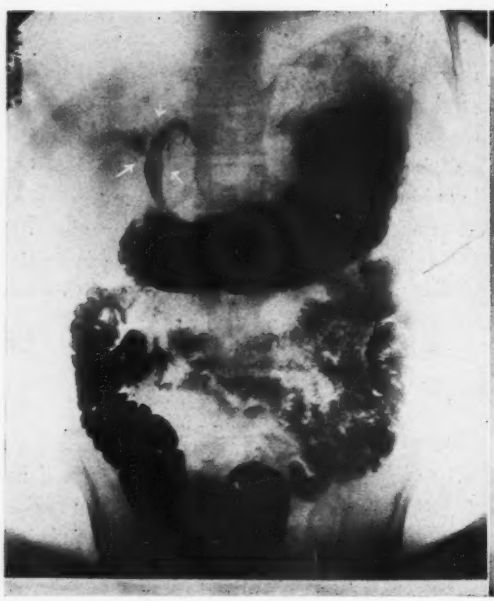


Fig. 1. Case 7. Patient prone, film taken soon after a barium meal. The extra-hepatic bile ducts are filled (arrows).

Fig. 2. Case 7. Appearance a few minutes later than shown in Figure 1. Note filling of intra-hepatic ducts as well.

cap; and, from it, thin streams of barium radiated upward, branching as they reached the liver (see Figs. 1 and 2). Despite this distinct visualization of the bile ducts, the gall bladder did not fill. Six hours after the barium meal, the stomach was empty, but the bile ducts were still visible.

The patient remained comfortable until April 17, 1926, when some of the previous symptoms returned. A second roentgen examination, four months after the first, showed no change in the filling of the biliary tract.

The patient then disappeared from observation. It was later learned that in August, 1926, he was far from well, and was admitted to the Naval Hospital in Brooklyn, where he died suddenly from some intra-abdominal complication, the exact nature of which was not determined. There was no autopsy. In the absence of clinical evidence of gall-bladder disease in this case, the filling of the bile ducts was explained on the assumption that we were dealing with a penetrating ulcer of the duodenum that had ruptured into a bile duct. The probable diagnosis, therefore, was: Duodenal ulcer with spontaneous duodenocholedochostomy.

Case 9.—Woman, 63, referred November 30, 1926, by Dr. H. F. Strongin. Thirty-six years ago, onset of attacks of pain in epigastrium and back. From twenty-two to eighteen years ago, severe right upper abdominal pains, with vomiting and jaundice, and weight loss to the lowest point, namely, 80 pounds. From eighteen to eight years ago, there was a free interval, which should be emphasized. Eight years ago, the symptoms recurred, but the pain and jaundice were definitely less marked than formerly. For the past two years, there had been almost daily pains, worse one hour after eating. Vomiting occurred about once a week, and there was a 28-pound weight

loss during this interval. There was no jaundice.

Physical examination, November 30, 1926, revealed, as the chief abnormality, a large, tender liver. The weight was 113 pounds. A test meal showed normal acid values, and contained a few small balls of mucus, stained an intense dark green.

Roentgen examination after a barium meal, December 1 to 6, showed a free filling of the bile ducts well into the liver substance (Figs. 3, 4, and 5) without, however, visualizing the gall bladder. Some of the ducts retained the barium for at least 120 hours, when the examination was discontinued. Another barium meal, administered December 9, showed the same condition.

In October, 1927, Dr. Strongin reported that the patient's condition had improved on rest treatment with frequent small feedings. The pains were less, the vomiting had practically ceased, and there had been a gain in weight to 129 pounds.

Our diagnosis in this case was: Cholelithiasis, with spontaneous choledochoduodenostomy probably of eighteen years' standing.

Fig. 3. Case 8. Patient standing. The extrahepatic ducts are filled (arrows).

COMMENTS

Case 2.—The explanation that the bile-duct visualization in this case was produced by a retrograde filling through a patent papilla of Vater is open to question. The dilatation of the bile ducts following cholecystectomy, in our opinion, is perhaps more likely to be associated with increased spasm of the papilla of Vater than with a relaxation of this apparatus. Possibly a more reasonable explanation of this case is that a gallstone had at one time ulcerated into the duodenum, either by way of the papilla, with destruction of the sphincter function, or that it had perforated at some point higher up. Still another possibility is that a duodenal ulcer may have penetrated into the bile ducts (see below, Case 8).

Case 3.—The filling of the gall bladder with air or gas may be taken as definite proof of a biliary fistula. Mayo Robson (9) found two such instances at operation. Judd and Burden (10) also mentioned this finding. Finally, Mallet-Guy and Beaupère (11) have often observed air in the gall bladder following the operation of cholecystogastrostomy.

The association of biliary fistula with a pancreatic abscess has been previously described in the literature. Thus, Rolleston (12) reports the case of a woman of 54 who had diabetes of pancreatic origin, and was jaundiced. "The gall bladder was shrivelled up on a gallstone, and communicated by a fistula with the first part of the duodenum. There was a soft . . . calculus . . . in the lower part of the common bile duct. Near this calculus . . . there was an abscess, partly in the

Fig 4. Case 8. Appearance 5 hours after the barium meal. Note widespread filling of intra-hepatic bile ducts (arrows).

Fig. 5. Case 8. Appearance 72 hours after the barium meal. Note retention of barium in some of the intra-hepatic bile ducts (arrows).

head of the pancreas, and partly in the lesser omentum and left lobe of the liver."

The explanation in this case, namely, that vomiting had forced the barium up the bile ducts through an insufficient papilla, is unwarranted, because, as far as we know, such insufficiency is not known to exist clinically; and, if it did exist, such cases would surely have been often encountered in the past, considering the innumerable vomiting patients who have been subjected to barium-meal examinations.

Case 5.—In contrast to the ready filling of the bile ducts after a choledochoduodenostomy, as described in this case, it may be of interest to report that, so far as the available literature goes, this phenomenon does not seem to occur after operations uniting the *gall bladder* with either the stomach or the duodenum. Thus, Mallet-Guy and Beaupère (11) fail to mention bile-duct visualization after X-raying 10 cases of cholecystogastrostomy; nor does Case (13) report bile-duct filling in his two patients who had undergone cholecystenterostomy.

Case 8.—Mayo Robson (9) reports that both ulcer of the duodenum and ulcer of the pylorus may perforate into the bile passages.

Case 9.—The free interval of ten years observed in this case in all probability followed the spontaneous establishment of the biliary fistula. Judd and Burden (10) have observed the same phenomenon, and graphically describe the natural history of fistula formation as follows: "In a study of the histories of these patients, it was noted that a considerable number had had severe symptoms of gall-bladder disease with hepatic colic, jaundice, chills and fever, for from fifteen to twenty years previous to examination in the [Mayo] Clinic. Then, following a particularly severe attack, all

symptoms were apparently relieved for from six to eight years. The period of apparent well-being probably followed the formation of the fistula."

SUMMARY

1. The positive diagnosis of internal biliary fistula has, until recently, been possible only at operation or autopsy.

2. Internal biliary fistula can now be diagnosed in the intact living subject roentgenographically.

3. A characteristic roentgen finding in internal biliary fistula is the visualization of the bile ducts after a barium meal.

4. Only five cases of such duct visualization due to spontaneous internal biliary fistula formation have been reported in the literature to date. Two new cases are described in this article.

5. In addition to bile-duct visualization in spontaneous internal biliary fistula, the ducts may be filled and visualized either through an external biliary fistula or following the operation of choledochoduodenostomy.

6. Bile-duct filling and visualization have not been reported to date, following the operations of cholecystogastrostomy or cholecystenterostomy.

REFERENCES

1. Carman, R. D., and Miller, A.: The Roentgen Diagnosis of Diseases of the Alimentary Canal. Philadelphia, W. B. Saunders Co., 1917, p. 369.
2. Stephenson, F. B.: Opaque Meal in the Liver Ducts. Jour. Radiol., April, 1921, II, 35-40.
3. Beall, F. C., and Jagoda, S.: Injection of the Bile Ducts with Barium. Jour. Amer. Med. Assn., March, 1921, LXXVI, 1483.
4. Duval, P., Gatellier, and Beclere, H.: Étude Radiologique des Voies Biliares Normales et Lithiasques. Arch. d. mal. de l'app. digestif, etc., November, 1922, XII, 377-472.
5. Tenney, C. F., and Patterson, S. H.: Injection of Bile Ducts with Bismuth Paste and Observations on the Flow of Bile. Jour. Amer. Med. Assn., 1922, LXXVIII, 171-173.
6. Lenk, R.: Roentgenologische Darstellung des Gallengangsystems. Wein. med. Wchnschr., 1925, LXXV, 1594.
7. Habbe, E., and Smith, L. A.: Unusual Bile Duct Visualization by Roentgenograms of Barium Meal. Jour. Amer. Med. Assn., 1926, LXXXVI, 476-478.
8. Fishbaugh, E. C.: Duodenal Stagnation. Trans. Sect. Gastro-enter. and Proctol., Amer. Med. Assn., 1926, p. 200.
9. Robson, A. W. M.: Fistula between the Stomach and Bile Passages. Brit. Med. Jour., 1909, I, 1050-1054.
10. Judd, E. S., and Burden, V. G.: Internal Biliary Fistula. Ann. Surg., 1925, LXXXI, 305-312.
11. Mallet-Guy and Beaupere: Exploration Radiologique des Bouches de Cholecystogastrostomie. Arch. d. mal. de l'app. digestif, etc., 1926, XVI, 686-706.
12. Rolleston, H. D.: Diseases of the Liver, Gall Bladder, and Bile Ducts. London, Macmillan & Co., 1912, p. 768.
13. Case, J. T.: Roentgen Observations on the Duodenum, with Special Reference to Lesions Beyond the First Portion. Amer. Jour. Roentgenol., 1916, III, 314-326.

COLONIC DYNAMICS[1]

By L. J. CARTER, M.D., The Bigelow Clinic, BRANDON, MANITOBA

THE purpose of this paper is simply to furnish an introduction to the symposium on colonic conditions, by briefly summarizing colonic function as it may be interpreted from the radiological examination.

The first thing that should be said is that we must not look for any standard by which to judge all colons. The normal colon may show wide variations in shape, size, position, and mobility. Apart from the changes produced by inflammatory processes and newgrowths these variations will be determined by one or both of two main factors. The first factor which makes for diversity in colonic appearance is the general conformity which colonic morphology bears to the type of bodily habitus of the individual. The second factor responsible for variations in colonic appearance is the possibility of arrest of colonic development, which may occur at any stage of embryologic life.

These morphological changes, which occur as the result of the two factors mentioned, are not pathological *per se*, and are of importance only as they interfere with the discharge of normal colonic function. While they thus frequently occur within normal limits, and are not necessarily incompatible with normal function, yet they may furnish the avenue along which pathology proceeds. So, while it is necessary to remember the physiological nature of many of these variations, it is still more important to understand the nature of the pathology to which they may give rise, and to recognize the signs of that pathology when it has supervened.

The first factor mentioned as governing variation in colonic morphology, as emphasized by the late Dr. Walter Mills, is the bodily habitus of the individual. Body types vary from the hypersthenic on the one extreme to the asthenic on the other.

The hypersthenic individual — short, stout, and heavily built—has a typical colon. The cecum is high, the transverse colon straight and high, the descending colon straight and long. The pelvic colon rises high out of the pelvis, with a single circular curve. There is a long anal canal and only moderately capacious ampulla. The whole colon is hypertonic, haustrations are fine, motility is rapid, and there is a tendency to spasticity.

At the other extreme, the asthenic individual—tall, slim, and lightly built—has also a typical colon. The cecum is low, atonic, and large, often lying low in a capacious pelvis. The transverse colon is low and looped even as far as the pelvis. The descending colon is frequently redundant. The pelvic loop often fails to rise out of the pelvis. The rectal ampulla is large and the anal canal short. The whole colon is atonic, haustrations are coarse, motility is slow and there is a tendency to redundancy.

Between these two extremes of bodily habitus lie the sthenic and the hyposthenic, with colonic characteristics showing various steps of gradation between the two extremes.

This correspondence of colonic type to bodily habitus furnishes one standard for the estimation of colon abnormality. For instance, if the pelvic colon of the asthenic individual is seen high out of the pelvis, some explanation should be sought, some type of pelvic tumor should be looked for. Again, if the cecum or the pelvic colon of the hypersthenic individual be found fixed in the pelvis, some explanation must like-

[1]Presented before the Twelfth Annual Meeting of the Radiological Society of North America, at Milwaukee, Dec. 1, 1926.

wise be looked for, some pelvic inflammatory process must be sought.

Further, the extremes of colonic morphology, corresponding to the extremes of bodily habitus, may in their very nature predispose to certain pathological changes. For instance, the low, atonic, slow functioning colon of the asthenic individual, while not incompatible with good function and normal health, may itself be the result of loss of tone, form, mobility, and position of a formerly normal type. And it is the general experience that this type of colon lends itself readily to stasis and all the evil results of intestinal intoxication.

On the other hand, extreme spasticity, a characteristic complication of the hypertonic, rapidly acting colon, exercising itself most where the colon is narrow and constricted, and so frequently involving the sphincter areas, produces a type of constipation which is probably no less damaging in its results than is the stasis due to atonicity. In addition, diverticulitis and diverticulosis occur more commonly in the hypertonic colons of hypersthenic individuals.

The second factor mentioned as governing variation in colonic morphology is the arrest of progress which may occur at any stage of the embryological development of the colon. The four main stages through which the colon passes in its progress to full development are migration, rotation, descent, and fixation. Any one of these four processes may be deficient or excessive, giving rise to conditions which make colonic physiology difficult of normal functioning. This difficulty in physiological functioning may, under unfavorable conditions, pass over into the realm of the pathological.

Failure to properly migrate may result in a left-sided cecum. Failure to properly rotate may result in the placement of the ileum in front or behind or to the right of the cecum instead of in its normal position to the left. There will be resultant ileal kinking and consequent stasis. Failure to descend would leave the cecum high, while excessive descent would place the cecum in the pelvis. Irregularities of fixation in the right half of the colon would give rise to such conditions as fixed cecum, mobile cecum, mobile hepatic flexure. Similar defects in the development of the left side of the colon would produce corresponding abnormalities in that part of the large bowel.

All such variations should be recognized by the radiologist. He should have some clear idea of the cause of their production, whether it be simply conformity to the bodily habitus of the individual, or the result of faulty development. He should also be able to give some estimate of their effect upon the discharge of proper function, and, collaborating with the clinical history, indicate in what cases the potentiality towards pathology has passed over into the actuality.

From such a study of the twofold causation of colonic variation one may readily predict what will be the weak point in the colon, and what will be the relative liability to malfunction and disease of the various sections.

The weak spots in the colon are those areas where narrowing of the lumen is liable to occur through angulation or muscle spasm or inflammatory processes, or where important sphincteric areas are situated. Such weak spots are the ileo-cecal sphincteric area, the ascending colon at or near the level of the crest of the ilium,—the cecocolic sphincteric area,—the transverse colon just to the left of the hepatic flexure, the splenic flexure, the descending colon at or about the level of the crest of the ilium, the junction of the iliac and pelvic colons, the recto-sigmoidic sphincteric area, and the rectal sphincters.

In a study of the results of a thousand barium enemas the writer drew the conclusion that the ileo-cecal region was the most

common site of colonic pathology. Several years of observation since that opinion was given have but confirmed the conclusion. The recto-sigmoidic sphincteric area is believed to be the next most frequent offender, although the writer is aware that some of the most experienced radiologists consider the recto-sigmoid area as the most common site of trouble.

Reasoning *à priori* would seem to point to the ileo-cecal region as being the most liable to trouble. For here we have what does not occur elsewhere in the colon—a double possibility of disease. Not only is there situated here one of the most important sphincters in the body, from the standpoint of absorption, but here also is one of the greatest trouble producers—the appendix. The only combination which can compare with the ileo-cecal-appendiceal one as a site predisposing to disease is the gall bladder-pyloric-duodenal-pancreatic complex.

The recto-sigmoid sphincter area also has great possibilities as a trouble-maker. This is the narrowest part of the colon. Spasticity resulting from irritation here will produce the retention of the fecal mass in the pelvic colon, with consequent dilatation, even to the extent, some have claimed, of causing Hirschsprung's disease. Relaxation here will lead to a constantly filled rectum, —rectal constipation. Carcinoma, diverticulitis, and ulceration are common in this section of the colon. It is the most difficult portion of the large bowel to visualize with the X-ray. The examination requires great care and special technic, and should be supplemented by the sigmoidoscope in clinically indicated cases.

From such a consideration of the morphological appearance of the pathological colon as we have just outlined, one naturally asks what is the significance of this visualized pathology in terms of perverted physiology. Such a question has, up to the present time, received no adequate answer, for the simple reason that we have had but a very crude conception of the workings of gastro-intestinal physiology. We have observed such phenomena as peristaltic activity, valvulæ conniventes, haustral markings, sphincteric action, but we have had no clear understanding of the method of their initiation or conduction or of their interrelation. We have known that intestinal metabolism has been in some way related to these observed phenomena, but have had no adequate understanding of the *modus operandi* of this relation. In short, colonic dynamics has been a comparatively unexplored field.

But in all this there has surely been no reason for the heart-burnings and bitterness which some radiologists have shown in deriding their own science, while stating that we began with pathology when we should have begun with physiology.

The science of radiology in its gastro-enterologic phase has simply been passing through the stages through which all science has passed: first, observation; then correlation of facts observed, and, finally, the evolution of a theory to explain the facts or the discovery through the experimental route of the principles which underlie the phenomena observed. Thus far we have been observing facts and correlating them, and establishing a standard for the normal and for the pathological. At last there are indications that we are entering upon the final stage of our science—the discovery of the underlying principles of intestinal activity.

The present status of the gastro-intestinal radiologist has been compared with that of the cardiologist of fifty years ago. The student of cardiac disease was then concerned chiefly with heart murmurs. But, thanks to the invention of the electrocardiograph and other instruments, he is more concerned now with heart impulses, where

they arise and how they are conducted. A similar change is beginning to dawn upon the radiologist's horizon. Thanks to the epoch-making work of such pioneers in the new field as Cannon, Cole, Barclay, Forssell, Alvarez, and others the radiologist bids fair soon to understand the cardinal principles governing the initiation and conduction of intestinal impulses, the results of which he has been observing for so long.

The new approach has come through the application to the study of the gastro-intestinal tract of the methods of experimental physiology which have been so fruitful of discovery in other fields, Cannon being the prophet of the epoch, having, fifty years ago, opened the abdomen of the living animal for purposes of observation. Already we can see that there is beginning to open up for us an entirely new conception of the significance of the things we have been observing, and the prospect of seeing many new things for which we have heretofore had blind eyes.

It is too early to appraise the far-reaching possibilities of this new work, or even to indicate the lines along which it must ultimately proceed; suffice it to point out some of the paths along which the light is already beginning to shine.

Reverting to the comparison of the radiologist with the cardiologist, Cole was the first to show a gastric systole comparable to the systole of the cardiac cycle.

Then followed Barclay with the illuminating results of his study of the functions of the muscles of the stomach.

At the same time Forssell reported the results of his study of the mucous membrane movements of the intestinal tract. He showed that they are not merely a passive folding, the result of peristaltic activity, of the musculature of the bowel, but that they are active movements initiated and controlled by the muscularis mucosæ itself. This autonomous independence of the mucous membrane is of great importance in the carrying on of the functions of digestion and absorption.

At the same meeting of the American Roentgen Ray Society at which the papers of Barclay and Forssell were read, Alvarez read a paper on "new light on gastric peristalsis," reporting original work which he had been following up for some time, and which he had reported in a previous communication. He described a machine which he called an "enterograph," and with which he elicited gastric phenomena similar to those demonstrated by the electrocardiograph with regard to the heart. This work has since been enlarged upon and carried into the whole intestinal tract, and reported in his recent book.

Some of Alvarez' conclusions may be briefly summarized. The gastro-intestinal tract is largely autonomous; that is, it carries within itself the mechanisms essential to peristalsis. The forces which initiate and control intestinal peristalsis lie largely within the walls of the gut itself. There is a rhythmic contraction of the smooth muscle of the intestine. The rate of contraction follows the system of gradients, decreasing in frequency from the pylorus downward according to the law of inverse proportion. Corresponding to these differences of rhythm rate are differences of irritability in the various sections of the bowel, decreasing also from the pylorus downward. These differences in rhythm rate and irritability account for the rapidly emptying duodenum and jejunum, the more slowly emptying ileum, and the colon movements—slowest and most sluggish of all. Correlated with these differences of rhythm and irritability are differences in metabolic rate in the various sections. In short, the intestinal tract is likened to a railway system. The entire tract is run on the block system. One block must be cleared before the following train can enter. The trains furnish

their own power. The nerve control simply regulates the traffic from block to block and in relation to the body as a whole. Disease processes disarrange the whole railway system. The rhythm gradient may be hastened or slowed or even reversed: in such cases we observe diarrhea or stasis or vomiting.

Such are the lines along which the new investigation of gastro-intestinal physiology is proceeding. What shall be the attitude of the practising radiologist to the new advance? He must await patiently the verifying of the conclusions of the experimental physiologists. When these are reasonably established he must endeavor to incorporate them in his own work. In the meantime he should be endeavoring to bring his science into line with the new trend of investigation. This can be accomplished only by the introduction of new methods of examination, the devising of new types of ingested meals, and possibly the invention of new machinery, for the purpose of focusing his attention upon those phases of intestinal activity upon which the experimental physiologist is placing emphasis. Only thus shall radiology take its rightful place as a science which has passed from the stage of objective examination and correlation of phenomena to the stage of subjective interpretation of their underlying significance.

COLONIC MALIGNANCY[1]

By W. H. McGUFFIN, M.D., Radiologist to the Calgary General Hospital, Holy Cross Hospital, and Radium and X-ray Institute, CALGARY, ALBERTA, CANADA

ONE might state without fear of contradiction that there is no more insidious form of malignant growth than that which makes its dwelling place in the colon or in the rectum. The patient is usually beyond the age of 45 or 50, and up to the time he presents himself for examination has enjoyed good health. The remarks which I wish to make are based upon a review of 50 cases. The outstanding features from this study are as follows:

1. The late stage of the disease when the medical attendant is called upon for help.

2. We are not dealing with such an uncommon malady as was once thought.

3. Early symptoms can be found if looked for.

4. A larger percentage of males than females—ratio, 3 to 2.

5. Certain sections of the colon are affected more frequently than others. The following has been the order of frequency in my series: Sigmoid, rectum, cecum, descending, transverse, ascending.

6. Comparatively slow development of the growth.

Fig. 1. Adenocarcinoma of the cecocolic junction.

Fig. 2. Scirrhous carcinoma of the ascending colon.

Fig. 3. Adenocarcinoma of proximal half of transverse colon.

7. There is a very high percentage of correct X-ray diagnoses.

The early symptomatology and clinical picture of carcinoma are often masked and require careful investigation. We recognize certain conditions which require differentiation: namely, carcinoma, adenomatous and scirrhous types, particularly; ulcerative tuberculous colitis; hyperplastic tuberculous colitis; actinomycosis; acute and subacute appendicitis; extra-luminal inflammation and adhesions; fecal impaction; extrinsic pressure effects; syphilis; simple colitis;

[1]Read before the Radiological Society of North America, at Milwaukee, December 1, 1926.

TABLE I

Right Half of Colon	Adenocarcinoma	Scirrhous Carcinoma	Ulcerative Tuberculous Colitis	Hyperplastic Tuberculous Colitis	Actinomycosis	Acute and Subacute Appendicitis
Constipation	+ Late	+ Late	—	+ Late	+ Late	?
Diarrhea	+	+	+ Early	—	+ and —	—
STOOL Mucus	+ Early	+ Late	+	—	—	—
STOOL Pus	—	—	+	—	—	—
STOOL Blood	+ Early	+ Late	+ Rare[2]	—	—	—
Abdominal discomfort	+ Early	+ Late	+ Early	+	+	+
Pain to right umbilicus	+	+	+	+	+ Slight	+
Colonic distention	+ Early	+ Late	+	+ Late	+	+ Moderate
Palpable mass	+ Nodular	+ Resistant	—	+ Late	+ Late	—
Anorexia	+ Late	+ Late	— See Note[3]	—	—	+
Nausea and vomiting	+ Late	+ Late	+ Nausea — Vomiting	+ Late	+ Late	+
Borborygmus	+ Late	+ Late	—	+ Late	—	—
Elevation of temperature	+ Late	—	+ Early	—	+	+
Acute and chronic obstruction	+ Late	—	+ Late	—	—	—
Loss of weight	+ Late	+ Late	+ Gradual	+ Gradual	+ Late	+ Very gradual
Secondary anemia	+ Late	+ Late	+ Early	+ Late	+ Late	—
Miscellaneous	May encircle bowel. Secondary anemia without loss of blood is due to toxinemia produced by the impaired absorptive function of the mucous membrane of the bowel.		Ascites present. Involvement of other organs — example, larynx and lungs.	Involvement of other organs. Leukopenia. Late or fibrous stage of ulcerative colitis (Carman).	Sinus formation. Characteristic sulphur bodies in pus seen under microscope.	Leukocytosis during attacks.
Location	Any part of the colon.		Usually cecum and ascending colon.	Usually cecum and ascending colon.	More frequent in appendix, cecum, and ascending colon.	Cecal region.

[2]Because of the obliterative endarteritis characteristic of the tuberculous.
[3]Patients have a desire for food but the first few mouthfuls produce a sense of fulness and they do not wish for more.

TABLE II

X-ray Findings. Right Half of Colon	Adenocarcinoma	Scirrhous Carcinoma	Ulcerative Tuberculous Colitis	Hyperplastic Tuberculous Colitis	Actinomycosis	Acute and Subacute Appendicitis
Outline	Serrated filling defect.	Annular filling defect.	Loss of haustrations.	Smooth filling defect.	Local loss of haustrations.	Flattening of lower inner border of cecum.
Lumen	Digitations and tunneling of barium shadows into lumen.	Central canal—napkin-ring deformity.	Narrow, due to thickening of walls.	Deformed, due to encroachment of fibrous tissue.	Flattening of wall.	Narrowing of cecum.
Mass	Palpable but not particularly tender.	Palpable.	None.	Present.	Not present.	Palpable and tender.
Mobility	Fixed if extension into surrounding tissue.	May be mobile.	Not fixed.	Fixation.	Fixation from inflammatory extension.	Fixation.
Motility	Obstruction varying with degree of growth.	Moderate obstruction. See Note[4].	Rapid evacuation of involved segment.	Some obstruction.	No obstruction.	Usually obstruction.
Dilatation	Proximal to growth (meal) and distal to growth (enema).	Present.	Not present.	Occasionally, of ileum.	Not present.	In terminal ileum.
Gas	Occasionally.	Present.	Present.	Present.	Not present.	Present.
Spasm	Rare—See Alvarez.	Rare.	Present.	Present.	Present.	Present.

[4]Many observers have commented upon the funnel-shaped defect at the site of newgrowth, noted after ingestion of the barium meal, and the rather abrupt obstructive filling defect observed after the ingestion of the barium enema.

TABLE III

Conditions Affecting Right and Left Portions of Colon	Extra-luminal Inflammation and Adhesions	Fecal Impaction	Extrinsic Pressure Effects	Syphilis
Constipation	+	+	+	—
Diarrhea	—	—	—	+
STOOL Mucus	—	—	—	+
STOOL Pus	—	—	—	+
STOOL Blood	—	—	—	+
Abdominal discomfort	+ Early	+	+	+ Cramps
Pain in abdomen	+	+	—	+
Colonic distention	+	+	—	—
Palpable mass	—	+	+	—
Anorexia	—	—	—	+
Nausea and vomiting	+	+	—	+ Late
Borborygmus	—	—	—	—
Elevation of temperature	—	—	—	+
Acute and chronic obstruction	+ Late	+	—	—
Loss of weight	—	—	—	+ Early
Blood examination	—	—	—	+ Wassermann
Miscellaneous	Rigid abdominal wall in extra-luminal inflammations.		See list of causes, Note[5].	History plus presence of mucous patches on the mucous membranes. Skin rashes.
Location	Any part of the colon, but particularly the cecum, hepatic flexure, and sigmoid.	Any part of the colon.	See Note[5].	Any part of the colon.

[5]Extrinsic pressure:—
Right Side—Cecum and Ascending Colon.
Appendiceal abscess, psoas abscess, bony tumor and abnormalities, ovarian cyst, pyosalpinx, floating kidney, kidney tumor, gall-bladder cyst and liver tumor or abscess.
Transverse Colon—Spine—Pott's disease, scoliosis and cardosis—stomach tumor, pancreatic growth or cyst.
Left Side—Splenic enlargements—kidney tumor or displacement.
Iliac and Pelvic Colon—Bony abnormalities, pelvic disease, pregnancy.
Rectal—Uterine displacements, bony abnormalities, prostatic enlargements.
General—Fluid (ascites), peritoneal tumors, omental tumors.

Fig. 4. Colloid carcinoma of distal half of transverse colon.

Fig. 5. Scirrhous carcinoma of upper descending colon.

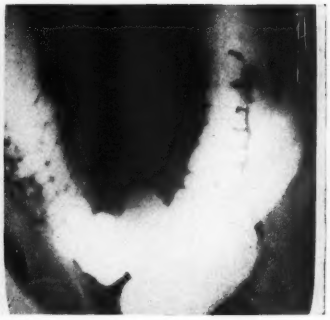


Fig. 6. Scirrhous carcinoma of descending colon.

TABLE IV

X-ray Findings. Right and Left Portions of Colon	Extra-luminal Inflammation and Adhesions	Fecal Impaction	Extrinsic Pressure Effects	Syphilis
Outline	Clear-cut deformity.	Smooth.	Regular, smooth walls.	Loss of haustrations.
Lumen	Encroachment.	Dilated.	Narrowed at point of pressure.	Narrow.
Mass	Palpable.	Palpable, doughy, not tender.	Extra-luminal.	None.
Mobility	Fixation.	Not fixed.	Bowel mobile.	Not fixed.
Motility	Moderate obstruction.	Obstruction.	Moderate obstruction.	Rapid.
Dilatation	Proximal.	At site.	Proximal.	None.
Gas	Present.	Present.	Present.	Present.
Spasm	Present.	Present.	Present.	Present.
Miscellaneous		Changes position at subsequent examinations.	Keep in mind herniæ and megacolon. See Note[6].	Findings similar to ulcerative colitis.

[6]Observations:—It seems advisable to make one large film of the abdomen and pelvis before the administration of a barium meal or enema. Some idea may be obtained of the presence of abnormalities of the bone; urinary, biliary and mesenteric calculi; enlarged kidney, liver and splenic shadows; accumulations of gas, fecal matter or fecoliths and foreign bodies.

TABLE V

Left Half of Colon	Simple Colitis	Chronic Ulcerative Colitis	Diverticulitis	Adenocarcinoma	Scirrhous Carcinoma
Constipation	—	—	+ Slight	+ Early	+ Early
Diarrhea	—	+	—	+	+
STOOL Mucus	+	+ Early	—	+ Early	+ Late
STOOL Pus	—	+ Early	—	+ Early	+ Late
STOOL Blood	—	+ Early	—	+ Early	+ Late
Abdominal discomfort	+	+	+ Early	+ Early	+ Early
Pain to left of umbilicus	+	+	+	+	+
Colonic distention	+	—	—	+ Late	+ Late
Palpable mass	—	—	+ When peridiverticulitis	+ Occasionally	+ Occasionally
Anorexia	—	+	—	+ Late	+ Late
Nausea and vomiting	—	+ Late	—	+ Late	+ Late
Borborygmus	—	+	—	+ Early	+ Early
Elevation of temperature	—	+ Early	+ Late	+ Late. secondary infection.	+ Late. secondary infection.
Acute and chronic obstruction	—	—	+ Late	+ Late	+ Late
Loss of weight	+ Late	+ Early	+ Late	+ Rapid	+
Blood examination	—	Secondary anemia.	Leukocytosis	Secondary anemia.	Secondary anemia.
Miscellaneous		Sigmoidoscopic examination reveals numerous superficial ulcers or erosions irregular in outline — bleed easily. Abdominal wall retracted or scaphoid.	Vesical irritation.	Sigmoidoscopic or digital examination will often reveal this condition.	
Location	Distal half of colon.	Usually sigmoid and rectal colons.	Common in sigmoid.	Frequently in sigmoid and rectum.	Frequently in the descending colon.

Fig. 7. Adenocarcinoma of pelvic colon.

Fig. 8. Adenocarcinoma of rectosigmoid junction.

Fig. 9. Adenocarcinoma of rectosigmoid junction.

chronic ulcerative colitis; diverticulitis, and various benign growths.

CONCLUSIONS

In the review and study of the cases from which I have derived the foregoing data, I hope that I have been able to present some evidence which will assist the general practitioner in making a diagnosis of his carcinoma cases earlier.

Whether the malignant involvement is in

Fig. 10. Adenocarcinoma of rectosigmoid junction.

Fig. 11. Rectal carcinoma.

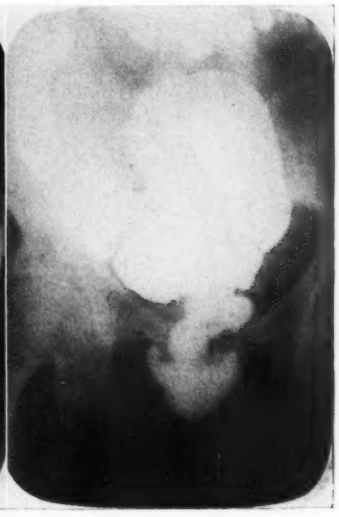


Fig. 12. Rectal carcinoma.

TABLE VI

X-ray Findings. Left Half of Colon	Simple Colitis	Chronic Ulcerative Colitis	Diverticulitis	Adenocarcinoma	Scirrhous Carcinoma
Outline	Loss of haustrations.	Loss of haustrations.	Irregular.	Serrated filling defect.	Annular filling defect.
Lumen	Narrow.	Narrow.	Extra-luminal shadows.	Digitations and tunneling of barium shadows into lumen.	Central canal — napkin-ring deformity.
Mass	None.	None.	Present when peridiverticulitis.	Palpable but not particularly tender.	Palpable.
Mobility	Not fixed.	Not fixed.	Fixed when peridiverticulitis.	Fixed if extension into surrounding tissue.	May be mobile.
Motility	Rapid.	Rapid.	Some obstruction.	Obstruction varying with degree of growth.	Moderate obstruction.
Dilatation	None	None.	Proximal.	Proximal to growth (meal) and distal to growth (enema).	Present.
Gas	Present.	Present.	Present.	Occasionally.	Present.
Spasm	Present.	Present.	Present.	Rare. See Alvarez.	Rare.
Miscellaneous	Stringy appearance of the barium shadow.	Sausage-shaped bowel segments.	Round shadows present after colon is emptied.		

the colon or in the rectum, painstaking care must be exercised to investigate all suspicious signs, and the earlier we make our diagnosis the more favorable the prognosis if surgical intervention is to be undertaken.

In the opening remarks of this paper it was stated that the percentage of correct X-ray diagnoses was fairly high. I wish to emphasize this statement and to suggest that we should never neglect to administer a barium enema to a patient complaining of gastro-intestinal disturbance.

ULCERATION OF THE COLON[1]

By BERNARD R. MOONEY, M.D., Radiologist to the Edmonton General Hospital, Edmonton, Alberta, Canada

UNTIL very recently the diagnosis and treatment of chronic ulceration of the colon presented many difficulties. Frequently the etiology was in doubt or dispute, and, as a natural result, the diagnosis and treatment were not satisfactory. When a specific cause could be found, as in amebic or bacilliary dysentery, luetic or tuberculous infection, or malignant ulceration, the diagnosis and prognosis were simplified. But after every reasonable effort to discover a definite cause, there still remained a large group of cases in which the etiological factor was obscure.

One would have expected that during the late war, when thousands contracted dysentery in the campaigns in Egypt and Gallipoli, and when careful and organized study was made, our knowledge of this condition would have been greatly increased. On the contrary, many cases, in which the specific ameba was found in the stools, and which were apparently cured, later developed a chronic ulcerative colitis and instead of the *Ameba histolytica* being found in the stools

Fig. 1, Case I. Chronic ulcerative colitis. Note narrowing of descending colon and loss of haustrations. Confirmed with sigmoidoscope.

Fig. 2, Case II. History of blood, pus and mucus in stools and diarrhea of 2 months' duration. Contrast enema showed definite intermittent spasm of sigmoid colon. Ulcers seen with sigmoidoscope. No bacilli or amebæ found in stools. Age of patient, 25 years. Appendicostomy and irrigation, with entire relief to date. Diagnosis: early ulcerative colitis.

[1]Read before the Twelfth Annual Meeting of the Radiological Society of North America, at Milwaukee, Wisconsin, Nov. 29–Dec. 4, 1926.

Fig. 3, Case III (above). Barium meal. Streaking of opaque material in descending colon suggesting colitis.

Fig. 4, Case III (below). Same patient as in Figure 3, above, after barium enema, which was poorly retained on account of irritability of colon and pain. Note loss of haustral markings and narrowing of lumen. Diagnosis of chronic ulcerative colitis was made and was confirmed with the sigmoidoscope.

streptococci were identified there (1). It follows that some of the acute specific forms predispose to a subsequent chronic so-called idiopathic form.

The research work and clinical results reported by Bargen (2) greatly clarify one angle of this subject. Referring to the so-called non-specific or idiopathic ulcerative colitis, he states: "Our recent experimental work has lead us to formulate two conceptions of this disease, and there can be no doubt that chronic ulcerative colitis is a disease entity: (1) the disease is of an infectious origin, and (2) the infection is conveyed by repeated 'showers' of bacteria being thrown into the circulation by a distant focus. The clinical history, the proctoscopic and roentgen-ray pictures, the gross and microscopic appearance, many of the complications, and the experimental evidence, substantiate these hypotheses most convincingly. A Gram-positive, lancet-shaped diplococcus, which has been isolated in a vast majority of cases of chronic ulcerative colitis, has previously been described. If searched for at the proper time I believe this organism would be found in all cases of the disease. The micro-organism is best isolated through the proctoscope from the scrapings and swabbings of the ulcers after thoroughly cleansing the surrounding mucosa." . . . "That the diplococcus described is of etiological significance seems unchallenged. The treatment, then, consists primarily in immunization against this organism."

It would seem then that the entity described by Bargen and known as chronic ulcerative colitis may follow and be distinct from amebic or bacilliary dysentery, and that these acute conditions are a predisposing factor. It may also result from focal infection, coupled with a weakened resistance of the colon (2).

If one keeps the pathology in mind, the X-ray manifestations are more easily under-

stood and accounted for. In the acute or initial stage of ulcerative colitis, spasm is a common X-ray sign (See Case II), and spastic colon is being considered in another

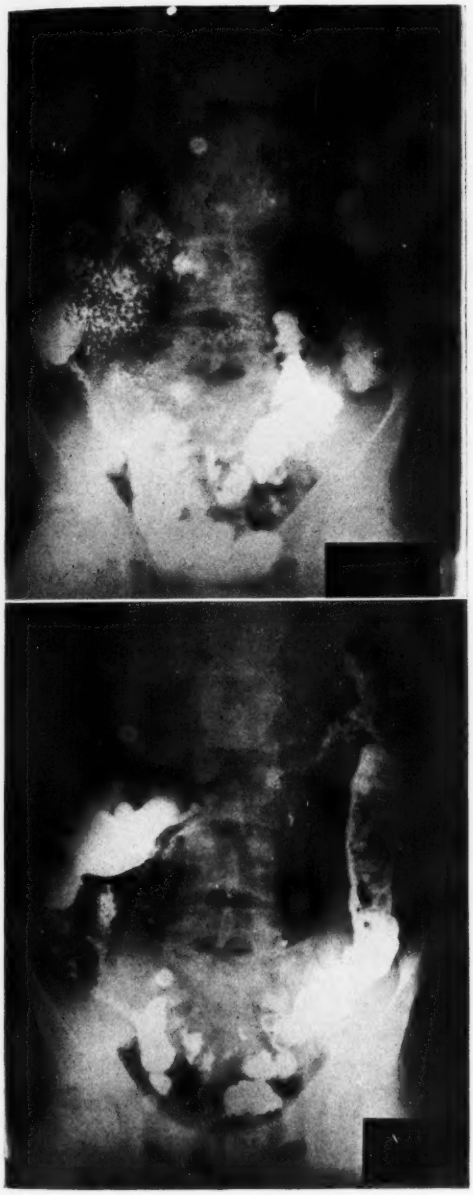


Fig. 5, Case IV (above).—Tuberculous colitis. Barium meal at 6 hours. Cecum filled and contrast material passed rapidly into descending colon. (Kindness of Dr. D. A. Stewart.)

Fig. 6, Case IV (below). Barium meal at 9 hours. Spasm of the cecum.

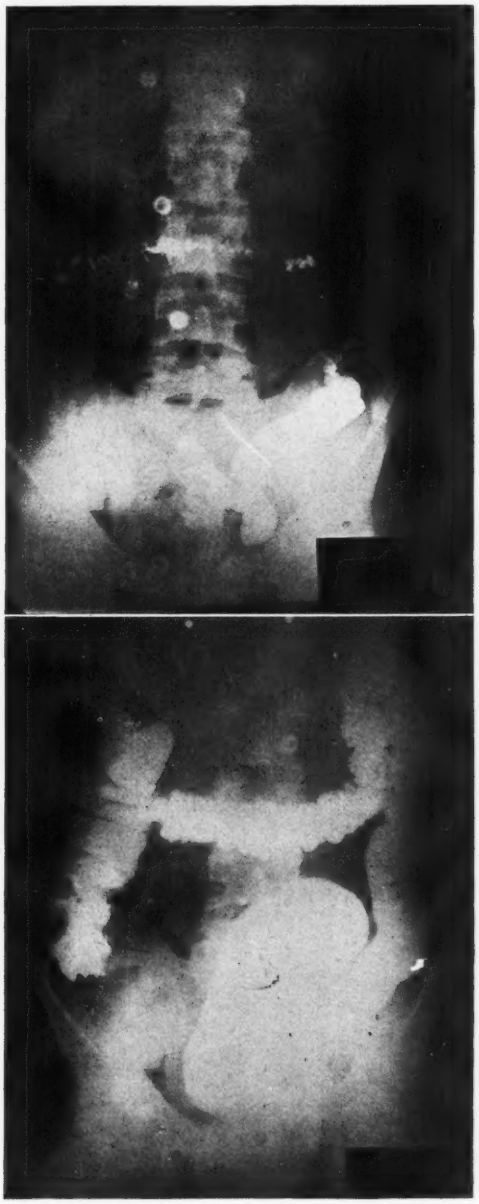


Fig. 7, Case IV (above). Barium meal at 13 hours. Contrast meal considerably advanced beyond its normal position at this period, indicating irritability of the bowel.

Fig. 8, Case IV (below). Same case as in Figure 7, above, after barium enema. Filling defects in the cecum. It will be noticed that the barium meal gives more information.

paper during this symposium.[2] Malignant disease of the colon forms the subject of another speaker.[3] There remain luetic ulceration, which is very rare; actinomycosis, the diagnosis of which is usually made by the pathologist; tuberculous and ulcerative colitis.

Fig. 9, Case V (above). Tuberculous ulceration of the colon. Barium meal at 9 hours. Plate made in May, 1923. Irregular filling of cecum, ascending and transverse colon. (Kindness of Dr. D. A. Stewart, Ninette, Manitoba.)

Fig. 10, Case V (below). Same case as in Figure 9, above, in May, 1923, showing the position of the meal and irregular defects at 12-hour period.

Very briefly would I remind you of the clinical course of ulcerative colitis, because, in the majority of cases, the history, clinical findings, bacteriological investigation and sigmoidoscopic examination are essential, as well as the X-ray report. It may be acute and fulminating, characterized by severe diarrhea, abundant blood, pus and mucus in the stools, severe abdominal pain, tenesmus, extreme prostration, and very often death. Improvement may slowly take place and apparent cure in some cases, but as a rule a train of symptoms persist, such as tendency to semi-liquid stools containing streaks of blood, pus, and mucus, and the sigmoidoscope may reveal not only active inflammation of the bowel, but actual ulcers remaining.

In another group the onset is insidious, and routine X-ray examinations of the gastro-intestinal tract may give the first hint of the real trouble. A twenty-four-hour plate showing the bowel empty or only streaks remaining in the descending colon (See Case III, Fig. 3), should excite suspicion and call for rigid inquiry into the history, and a barium enema. In regard to this treacherous form of the disease, a point worthy of comment is its chronicity and recurrent nature. The ulceration at first involves the mucous membrane, but gradually invades the deeper layers of the colon, causing abscess formation, which, in turn, results in fibrous tissue and narrowing of the lumen. The narrowing of the lumen and loss of the muscular coat present a characteristic radiographic picture. The haustral markings are absent, and the barium shadow is narrow and tube-like (See Case I).

[2] McMillan, J. C.: Spasticity of the Colon, this issue, page 35.

[3] McGuffin, W. H.: Colonic Malignancy, this issue, page 21.

In advanced cases the large bowel may appear like a string of sausage, as described by Carman (5).

The disease usually begins at the rectum and in time extends toward the cecum, but it may start in any portion of the colon. It is always better to confirm the X-ray findings with the sigmoidoscope, and to correlate them with a careful history. If the ulceration is in the lower bowel, and is seen with the sigmoidoscope, the diagnosis is confirmed; if beyond the reach of the sigmoidoscope, the history and clinical picture, as above described, are usually sufficient.

Judging from a review of the recent literature, and from personal observation, I believe that ulceration of the colon is not an uncommon disease, and that its early stages in particular are frequently overlooked. A diagnosis of neurasthenia, or what amounts to the same thing, is still too frequently made, and a large share of the blame for this is due to a negative X-ray report. The radiologist is a physician, and patients with confusing gastro-intestinal symptoms are usually first referred to him.

Tuberculous colitis is a very common occurrence in tuberculous patients. Stewart (3) states that 95 per cent show lesions in the bowels at postmortem examination. Pritchard, of Ninette Sanatorium, reports as follows (4): "In the past four years 377 of the tuberculous patients admitted were suspected of intestinal ulceration, and of the 300 suspicious cases investigated, 50 per cent were found positive and 20 per cent doubtful." He also states that every suspected case should be examined radiographically.

Tuberculous ulceration of the colon is usually confined to the cecum and ascending portion. Spasm, loss of haustrations, and filling defects are seen with the screen. The lumen of the bowel is encroached upon by the ulcerative process, and, as a result, there is definite, irregularly outlined narrowing of the shadow. When the plate is developed this part of the bowel may be

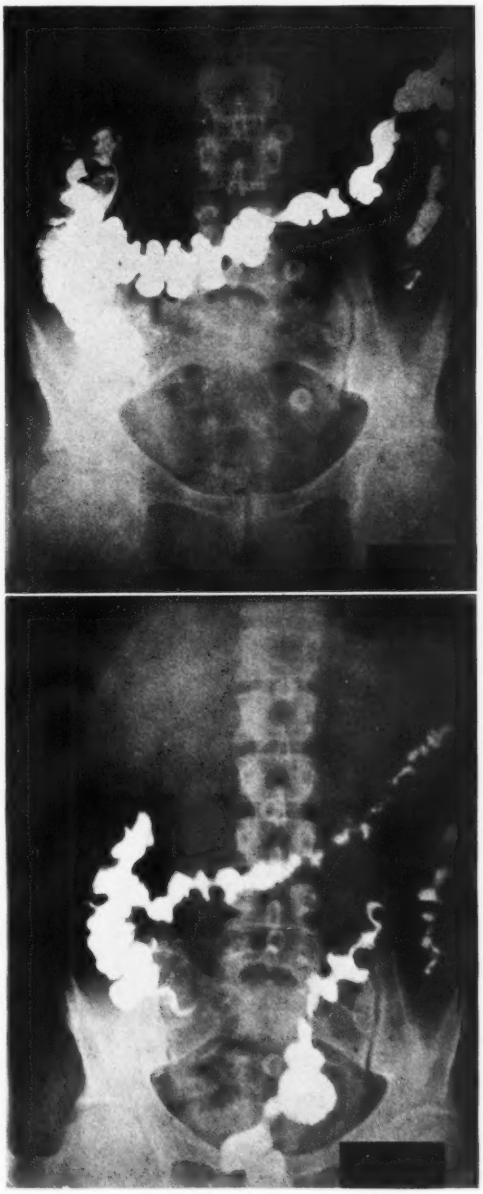


Fig. 11, Case V (above). Same patient as in Figures 9 and 10, after a barium meal, in February, 1926. Note definite improvement. The filling is nearly normal.

Fig. 12, Case V (below). Same patient as in Figures 9, 10, and 11. Barium meal at the 25-hour period, in February, 1926, confirming a marked improvement in about two years.

empty. This rapid emptying of the involved area is characteristic of tuberculous ulcerative disease. The above radiographic signs, coupled with clinical tuberculosis in any other part of the body, particularly the lungs, should make the diagnosis of tuberculous ulcerative colitis reasonably certain.

REFERENCES

(1) LOCKHART-MUMMERY, P.: Diseases of the Rectum and Colon. Macmillan Co., p. 414.

(2) BARGEN, J. A.: The Etiology and Treatment of Chronic Ulcerative Colitis. Am. Jour. Roentgenol. and Rad. Ther., July, 1926, p. 10.

(3) STEWART, D. A.: Tuberculosis: A Review of Sanatorium Cases. Journal-Lancet, March 1, 1924, p. 137.

(4) PRITCHARD, J. E.: Tuberculous Ulceration of the Intestines. Can. Med. Assn. Jour., January, 1924, p. 5.

(5) CARMAN, R. D.: The Roentgen Diagnosis of Disease of the Alimentary Canal. W. B. Saunders and Co., p. 582.

SPASTICITY OF THE COLON[1]

By J. C. McMILLAN, M.D., Winnipeg, Canada

DERANGEMENTS of the colon are responsible for many of the chronic abdominal complaints, and the most common of these derangements is spasm.

Spasm of the colon may be local or general. Local spasm involves generally the sigmoidal-colonic juncture, or the first part of the transverse colon. The bowel is narrowed in these localities for a variable extent, resembling an annular newgrowth. The portion of the bowel proximal is usually dilated. If the spasticity is general, the transverse and descending portions of the colon and the sigmoid are usually involved. Time does not permit me to go into details as to the possible cause of these spasms. Some of our surgical friends would have us believe that there is usually an underlying organic lesion, such as a diseased appendix, anal or rectal fissure, or ulcer. In my opinion, although these do occur, they are not at all common, but, of course, should be excluded in our examination.

The marked relief afforded some of these patients by proper dietary measures would lead us to suppose that, at least in a fair number, errors in diet and habits must constitute a cause. In others, no doubt, some derangement of the nervous control is a contributory factor. Color, sex, nationality, or age seem to play but little part in the occurrence of this condition, although we feel that it is more common in patients over thirty years of age. However, as stated above, we are not, at this time, so much concerned with the etiology as with the diagnosis.

Fig. 1. Barium meal, 5-hour residue, in transverse colon; spasm in first part of transverse colon.

Fig. 2. Spastic transverse and descending colon; cecum and ascending colon dilated.

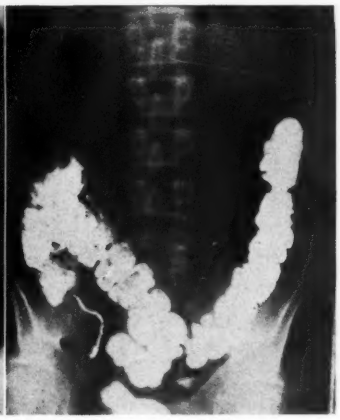


Fig. 3. Normal colon.

The patient may complain of a feeling of general abdominal discomfort, a "bloated feeling." Pain is also a common symptom. This may be general or local; either in the right or left lower quadrant, or beginning in the right and radiating across the ab-

[1]Read before the Radiological Society of North America, at Milwaukee, Nov. 29–Dec. 4, 1926.

Fig. 4. Spastic colon; opaque mixture broken up into boli.

Fig. 5. Barium enema; spasm at junction of descending colon and sigmoid.

Fig. 6. Barium enema; colon poorly emptied, with stringy appearance after evacuation.

domen to the left side. In our experience we generally find that these pains follow the course of the colon. Occasionally the pain is confined to the epigastrium. It may or may not have any relation to food. Pain coming on during, or immediately following, the meal is, in my opinion, very suggestive of colonic irritation. In some cases the pain complained of is very similar to that of ulcer. The pain in the right lower quadrant is perhaps responsible, in a large number of cases, for the diagnosis of chronic appendicitis.

One of my confrères is in the habit of telling the surgeons that an appendectomy without results to the patient is 50 per cent in favor of a spastic colon, and that an appendectomy and cholecystectomy, without results, is a positive diagnosis.

Alternating diarrhea and constipation is common. The diarrhea is explained by Alfred C. Jordan (1) as follows: "Nature attempts to evacuate the stagnant fecal matter by secreting mucus in the bowel. The success of the attempt is very limited. X-ray examinations with bismuth show the latter portions of the large intestine become reduced in caliber by spasm, while the cecum and ascending colon become dilated, and remain full of stagnant matter. In the hepatic flexure region, fecal material is suspended in mucus; in the rest of the large intestine small portions of material are propelled through the thread-like caliber of the contracted bowel as far as the rectum, to accumulate there until voided. Thus there may be frequent liquid stools—slimy from the pressure of mucus—and yet extreme stagnation in the cecum and ascending colon. This paradox often leads to misconception. A patient seeks advice for 'chronic diarrhea,' but is in reality suffering from severe constipation."

The patient may deny constipation, but state that the stool is composed of scybalous masses instead of the normally formed stool.

Another point we have often noted is that while the opaque mixture is throughout the large bowel the patients state they are more or less free from symptoms.

The physical examination may be negative, but there may be tenderness on palpation over the site of pain, or indefinite masses may be felt over any part of the colon.

Fig. 7. Barium enema; spiked appearance of descending colon; pre-diverticular state.

Fig. 8. Spiked colon, with small diverticula.

Fig. 9. Multiple diverticula.

X-ray examination is usually of very great service in the diagnosis of this condition. Both the opaque meal and the enema are of use. More information, I believe, is obtained from the former, because the condition is one of deranged function and not an organic lesion.

Examination following an opaque meal may show the following: The stomach may or may not show evidence of pyloric spasm.

Fig. 10-A. Case 1. Spasm in first part of transverse colon, with marked dilation of cecum and ascending colon.

Fig. 10-B. Same case, two months later. Spasm has disappeared; cecum and ascending colon much narrower.

Fig. 11-A. Case 2. Spasm in first part of transverse colon, with dilated cecum and ascending colon.

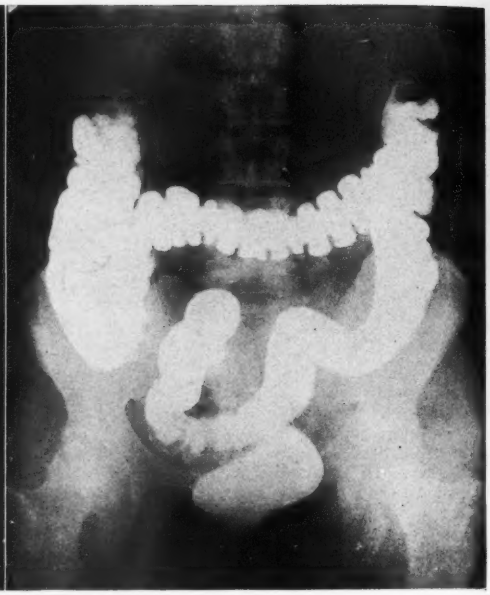


Fig. 11-B. Same case, six months later. Spasm absent; colon practically normal.

At the five-hour examination the stomach may be empty and the head of the column be in the cecum or ascending colon, a perfectly normal picture, or there may be a gastric residue with the head of the meal well on in the colon (Fig. 1). This would indicate an initial hypermotility followed by a hypomotility, due perhaps to a reflex pyloric spasm caused by the passing of the mixture into an irritable colon. When all the meal has reached the large bowel the greater part may be found to be massed in a dilated cecum and ascending colon, while the remaining portion of the bowel may be contracted (Fig. 2), in contrast to the regular normal haustral markings (Fig. 3).

The opaque mixture in the transverse and descending portions of the colon and in the sigmoid will be segmented or broken up into boli, giving rise to the scybalous form of stool mentioned above (Fig. 4). Subsequent examinations will show the spasticity more marked, without any progress or forward movement of the contents of the bowel.

With the opaque enema narrowed areas may be demonstrated, usually at the juncture of the sigmoid and descending colon, and in the first part of the transverse portion. The opaque mixture generally passes around the colon in a small stream and when it is completely filled the cecum and ascending colon will be found to be dilated, while the rest of the bowel is small, especially narrowed at the site of spasm, often simulating very closely annular newgrowth (Fig. 5). The colon is emptied poorly with evacuation and often presents a "stringy" appearance (Fig. 6). This is explained by Alfred C. Jordan (2) as a failure of the contracted colon to relax after passage of its contents. Occasionally the whole bowel may be devoid of haustral markings, producing the so-called "lead-pipe" appearance, or it may present in the

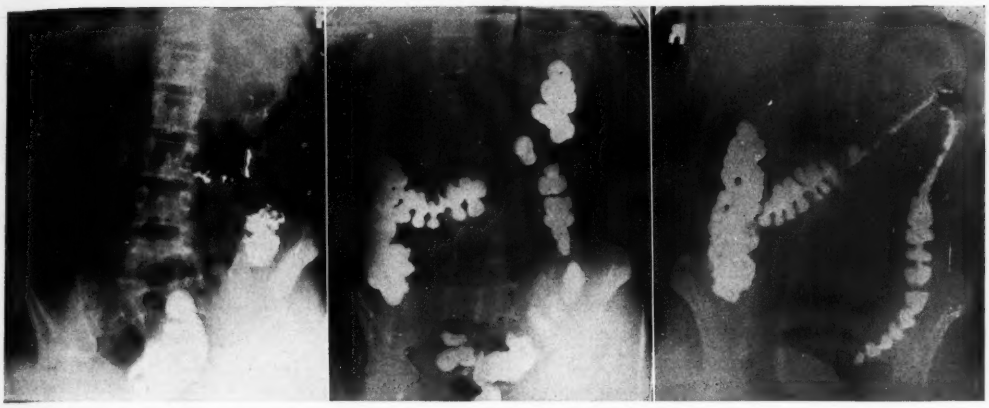


Fig. 12-A. Case 3. Barium meal, 24-hour examination; colon poorly emptied; stringy appearance; irritable.

Fig. 12-B. Same case, one year later. Spasticity of transverse and descending colons.

Fig. 12-C. Same case, two months later than Figure 12-B, following treatment; spasticity not so marked.

descending portion and the sigmoid a "spiked" or "saw-toothed" appearance, which we have learned to recognize as being associated with diverticulosis, and have been in the habit of describing as a spastic colon with a tendency to diverticulosis. By some it is described as a pre-diverticular state.

An interesting observation while performing a laparotomy is reported by Seymour Barling (3): "While under examination a most extraordinary sequence of events occurred, which in my experience was quite unique. At one point the bowel suddenly narrowed to half its previous diameter; this narrowing spread up and down for three or four inches, the bowel in this area becoming the size of the index finger and quite as firm. It was so rigid that it resisted flexion like a string of large beads tightly threaded. While the spasm lasted many tiny saccules appeared between the longitudinal bands; these were each segments of a circle about a third of an inch or less in diameter and lay regularly like beads along the sides of the gut. In a few seconds the spasm passed off and a nearly normal bowel remained, with faint evidence of the tiny projections indicated for a few seconds by the altered blood supply at their sites owing to the tension to which the peritoneum had been subjected. The cycle of spasm repeated itself thrice during the time the abdomen was open."

The same appearance is sometimes observed after an opaque meal. Figure 7 shows this "spiked" appearance of the descending colon.

Figure 8 shows a mixture of "spikes" and small diverticula.

Figure 9 shows multiple diverticula of the descending colon and sigmoid.

These plates were not made of the same patient, but may present steps in the formation of diverticula of the colon.

CASE REPORTS

Case 1. Patient, male, aged 50 years, complained of pain in right abdomen, with increasing constipation and marked loss of weight. Examined with opaque enema (Fig. 10-A). Narrowed area first part transverse colon, with marked dilatation of the cecum and ascending colon, measuring four and one-half inches across. Colon poorly emptied after evacuation. Antispasmodic given for four days, when the case was re-examined but showed no

change. The patient was then put on a proper diet with mineral oil and atropine, with marked relief of all symptoms. When re-examined in two months, the spasm of the first part of the transverse colon had practically disappeared. The cecum and ascending colon were smaller—three and three-quarters inches across. After evacuation the colon was practically empty.

Case 2. Female, aged 40 years. Opaque enema showed a narrowing of the first part of the transverse colon (Fig. 11-A). The colon on either side of this was dilated. This was confirmed by three examinations after administration of antispasmodic, with no change. The narrowing was about two and one-half inches in length, very closely resembling a newgrowth (Fig. 11-B). Six months later, after treatment, the spasm had disappeared, the colon being apparently normal.

Case 3. Patient, female, aged 22, an undergraduate nurse. Complained of pain and tenderness in the right side, which had lasted for a year. No acute febrile attacks. Bismuth series showed marked colonic hypermotility (Fig. 12-A). The colon had a "stringy" appearance; the appendix was poorly drained. Appendectomy was performed. Surgical report was, "chronic appendix." No relief of symptoms resulted. Second bismuth series, one year later. Twenty-four hour plate (Fig. 12-B) showed spasticity of the transverse and decending colons. The patient was put on a proper dietary treatment, and the symptoms practically disappeared in one month. Re-examined with barium meal. Twenty-four hour plate (Fig. 12-C) shows spasticity of the colon to be much less, although there is still some present in the sigmoid.

REFERENCES

(1) JORDAN, ALFRED C.: "Chronic Intestinal Stasis," Oxford Medical Publication, 1923. Chap. VIII, 51.

(2) JORDAN, ALFRED C.: "Chronic Intestinal Stasis," Oxford Medical Publication, 1923.

(3) BARLING, SEYMOUR: Pre-diverticular State and Diverticulosis. Brit. Med. Jour., Feb. 20, 1926, p. 323.

COLONIC STASIS[1]

By C. M. HENRY, M.D., C.M., Regina, Sask., Canada

COLONIC stasis is a delay or a retard of the colonic contents beyond the normal expulsive period. The normal filling and emptying time of the colon is somewhat variable, but the general impression is that the colon should begin to fill from the fourth to the sixth hour, following the ingestion of a barium meal. The head of the meal should be in the mid-portion of the transverse colon in seven to nine hours; the entire meal should have passed through the ileocecal valve in eight to ten hours; the entire colon should have filled in twenty-four hours, and be clear of the meal in from thirty-six to forty-four hours. Delays longer than these in any portion of the colon should receive further study and the causative factors producing this stasis be ascertained where possible.

A brief anatomical survey of the colon, as it normally lies in the free abdominal cavity and pelvis, with its attachments, its varied angulations and kinks occasioned by such attachments, may assist in understanding some of the pathological conditions found in certain apparently selective regions.

The cecum, when the barium-filled patient is placed in the erect position behind the fluoroscopic screen, should begin to fill from the fourth to the sixth hour, following the ingestion of the barium meal, and is designated as that portion of the colon that rests below the ileocecal valve. Its inferior border extends to the ileoperitoneal line, or mid-iliac fossa. Its average length is seven inches (Kantor), but may vary from four to nine inches, and its average diameter is about 2⅜ inches (Case).

Under the palpating finger it is freely movable from one to three inches, upwards or mesially. The meal should be out of the ileum and the tail of the meal wholly within the cecum at the tenth hour, and the latter should be empty in from fifteen (De

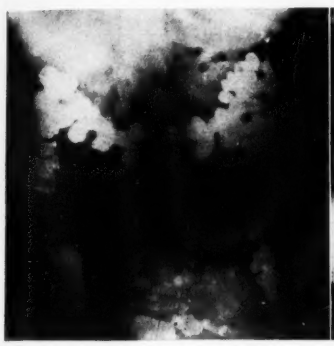


Fig. 1. Showing 48-hour retention: stasis in cecum: atonic: adherent at base.

Fig. 2. Colonic stasis, 32 hours: ileocecal valve incompetency: long pelvic cecum: adherent post-cecal kinked appendix: retention after 72 hours.

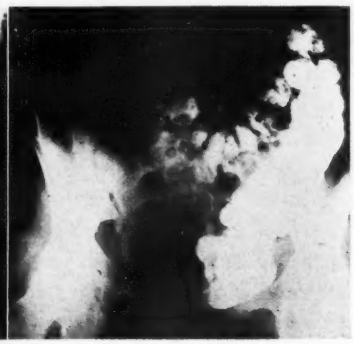


Fig. 3. Colonic stasis of cecum and ascending colon: adherent cecum—48-hour retention, following acute appendix. Condition relieved by operation.

[1]Presented before the Radiological Society of North America, at the Twelfth Annual Meeting, at Milwaukee, Dec. 1, 1926.

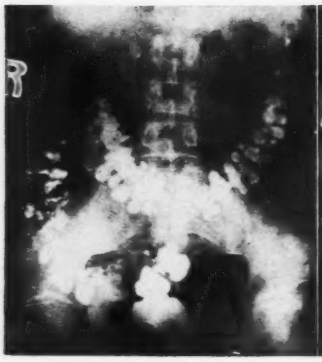


Fig. 4. Showing 72-hour retention: diverticulosis of cecum and ascending colon: prolonged stasis.

Fig. 5. Showing 48-hour retention: colonic stasis due to adhesions in the mid-cecal area and at the hepatic flexure.

Fig. 6. Showing 75-hour retention: colonic stasis due (reflexly) probably to duodenal ulcer.

Martel Antonie) to twenty-four hours (Hurst).

The cecum, however, is subject to great variations in size, length, and position, according to whether the patient is fleshy or thin. It lies low in the pelvis in from 15 to 18 per cent of cases. This condition is more commonly observed in thin than fleshy patients, and more often in women than in men by as much as 75 per cent. Pure cecal stasis in a low cecum occurs in one-third of the cases of low cecum (Kantor). Heredity and familial traits play an important part.

Conditions producing stasis in the cecum are: Incompetent ileocecal valve; adhesions and bands resulting from inflammatory conditions adjoining the cecum, producing fixation; non-rotation of colon; distal pathology producing reflex stasis, as:

(1) Redundant pelvic colon,
(2) Malignant disease of the rectum,
(3) Distal colonic diverticulosis,

Fig. 7. Showing 72-hour retention: colonic stasis: diverticulosis and presence of a penetrating gastric ulcer.

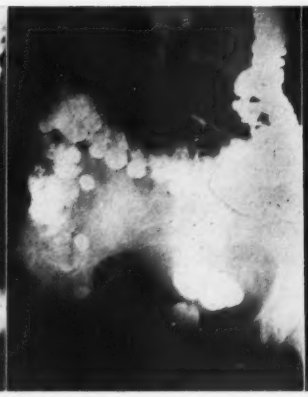


Fig. 8. Showing 100-hour retention: colonic stasis: atonic transverse ptosis: adherent cecum, with a long, irregularly filled appendix.

Fig. 9. Showing 72-hour retention: colonic stasis: redundant transverse colon: presence of gastric cancer.

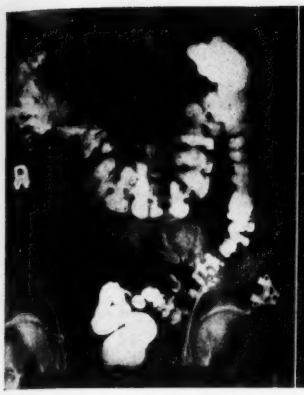


Fig. 10. Showing 48-hour retention: colonic stasis: multiple diverticulosis, with an adherent post-cecal appendix.

Fig. 11. Redundant iliocolon (barium enema): cecal stasis and incompetent ileocecal valve due to tumor mass in the descending colon. Barium meal showed a stasis of 96 hours.

Fig. 12. Showing 72-hour retention: intestinal stasis: colon atonic: ptosed. Case gave a history of chronic constipation.

(4) Distal tumors producing pressure defects (Case).

Added to these is deficient muscular and sympathetic nerve tone, either direct or remote, causing the cecum to lose its contractile power to produce mass movement of its contents, and failure to empty within a normal period of time, as found in—

(1) Ptosis and atonic colon,

(2) Chronic constipation.

The ascending colon extends from the ileocecal valve to the hepatic flexure, and is attached to the posterior abdominal wall by a short mesentery at both its proximal and distal extremities, while the central portion is more free. The ascending colon is movable mesially by the palpating hand, except near the hepatic flexure, where palpation is more difficult on account of the overlying ribs.

Stasis may be caused at the lower extremity of the ascending colon by (1) adhesions or bands produced by some infection relative to the appendix, ileum, or the gen-

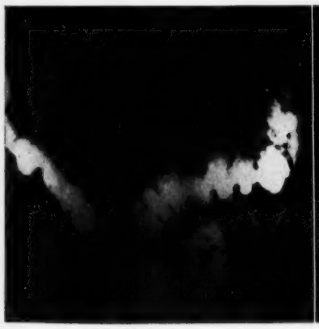


Fig. 13. Showing 72-hour retention: transverse colon retention: ptosis: adhesions in the transverse mid-portion. History of chronic constipation. Post-operative adhesions.

Fig. 14. Showing 72-hour retention: stasis in proximal colon due to strictural bands in the descending colon.

Fig. 15. Showing 48-hour retention: presence of multiple diverticula in transverse colon.

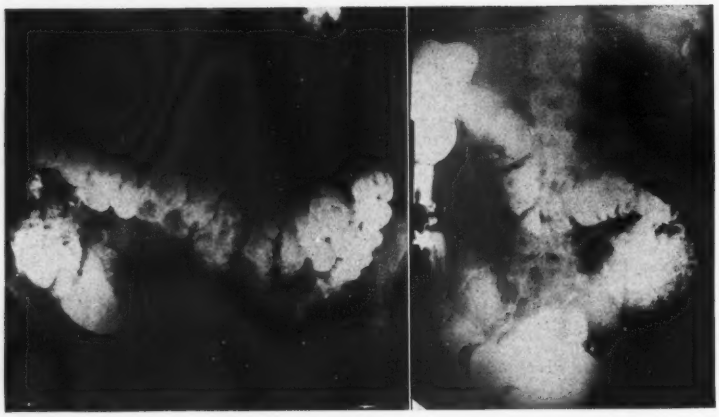


Fig. 16. Showing 96-hour stasis: ptosed, redundant transverse colon. History of obstinate constipation.

Fig. 17. Showing 48-hour retention: colonic stasis due to adhesions in the descending colon (post-operative).

erative organs in the female; (2) Jackson's membrane; (3) distal pathology in the descending colon or sigmoid, producing reflex stasis; (4) intrinsic or extrinsic conditions, as benign or malignant tumors, or a redundant colon.

At the hepatic angle, stasis is produced by bands and adhesions caused by inflammatory conditions from the gall-bladder or liver area, pancreas, or duodenum.

The transverse colon extends from the hepatic flexure to the splenic flexure, and, while its extremities have a short, mesenteric attachment, the mid-portion may have a long mesocolon. The normal position of the mid-transverse colon is markedly variable. In fleshy and short-waisted individuals the mid-transverse colon will rest on a high plane, at or above the umbilical line, while in thin, long-waisted persons, it rests

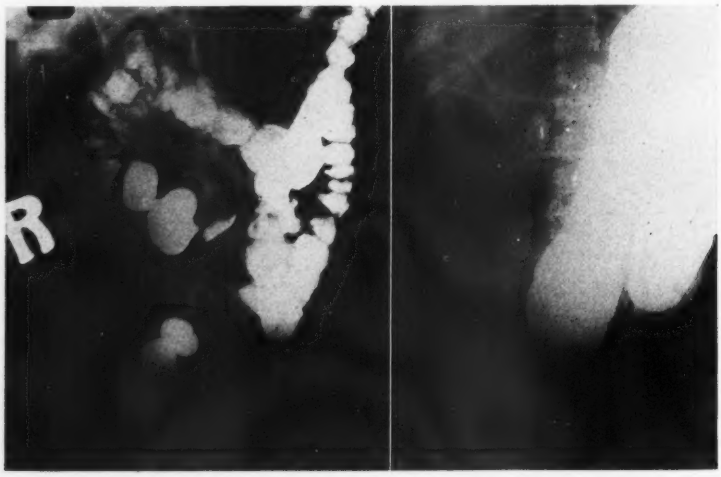


Fig. 18 A. Showing 72-hour retention: colonic stasis: redundant proximal colon. Patient 5 years of age.

Fig. 18 B. Same patient as shown in Figure 18 A. Hirschsprung's disease (barium enema).

lower in the abdomen. It is usually lower in the female than in the male, and lower in the narrow than in the broad pelvis.

In stasis, the central portion of the transverse colon is usually low, and may assume

Tumors, intra- or extra-mural, omental, or retroperitoneal, may be seen as pressure defects, and produce stasis either locally or remotely.

The descending colon extends from the

Fig. 19. Redundant iliac colon following barium enema. Patient 4½ years of age.

Fig. 20. Colonic stasis: reflex condition in the presence of tumor mass in the iliocolic area.

a "U" or a "V" shape. The hepatic and splenic angles are acute. The haustrations are commonly shallow or almost absent, and redundancy is a frequent occurrence, especially in patients with a history of constipation. This condition occurs in one-third of the cases reported by Dr. Case.

Diverticulosis is a concurrent condition and may be a causative factor.

When the transverse colon becomes dilated and its muscular tone inhibited, mass movements are retarded and dilation and elongation of the transverse tube occur. Atony may be present. The colon may lie in the true pelvic cavity. Redundancy, however, may be a congenital anomaly. Adhesions and bands producing contractures of the lumen are common at the hepatic flexure, but are seldom seen at the splenic flexure.

splenic flexure to the crest of the left ilium, and is the least movable part of the entire colon, but its attachments allow some movement mesially.

In stasis, the descending colon is displaced toward the median line as far as its mesentery will allow. This portion of the colon has a narrower lumen than the proximal colon, but in stasis the lumen may be as large or larger than the transverse colon, due to atony or over-distention from any cause. When stasis is present in this portion of the colon, atony follows, mass movements are inhibited—normally stronger here than proximally—and proximal stasis becomes more evident. Stasis due to bands or adhesions is not as evident here as are malignant diseases, and redundancy is not common.

The iliac colon extends from the crest of

the ilium to the inner border of the left psoas muscle, and the pelvic colon from the termination of the iliac colon to the front of the body of the third sacral vertebra, forming, when empty, an acute angle with the rectal ampulla (Cunningham). The average length is seventeen inches, but it may vary from five to thirty-three inches. It is bound closely to the walls of the pelvis by a short mesentery at either extremity but loosely in the central portion, allowing it freedom of movement, and also making it liable to dilation and redundancy occasioned by back pressure from the rectal colon, due to a spastic rectum from hemorrhoids, or from tumor formation. It is in this part that redundancy is most frequently found, and this section of the colon is most variable in its position. In stasis with redundancy, it may rest as high as the umbilicus in the mid-line or in the right or left iliac region. Due to its fixation and acute angulation at its distal extremity, and its proximity to the generative organs, especially in the female, it is subject to stasis from bands and adhesions and also is the seat of the major portion of the malignant disease affecting the whole colon.

Consequently the factors that produce general or local stasis in the colon, and others which are complementary conditions, either present or concomitant, are as follows:

1. Tumors, benign or malignant, pressing on the colon.
2. Uterine displacements.
3. Obstructive bands and adhesions
   - Post-operative,
   - Inflammatory,
   - Gall bladder,
   - Fallopian tube.
4. Kinking of colon
   - (*a*) Lane kink,
   - (*b*) Jackson bands.
5. Strictures produced by
   - (*a*) Ulcers,
   - (*b*) Annular carcinomas,
   - (*c*) Papillomas or lipomas.
6. Chronic constipation.
7. Redundant colon
   - (*a*) Due to gas distention,
   - (*b*) Atonic,

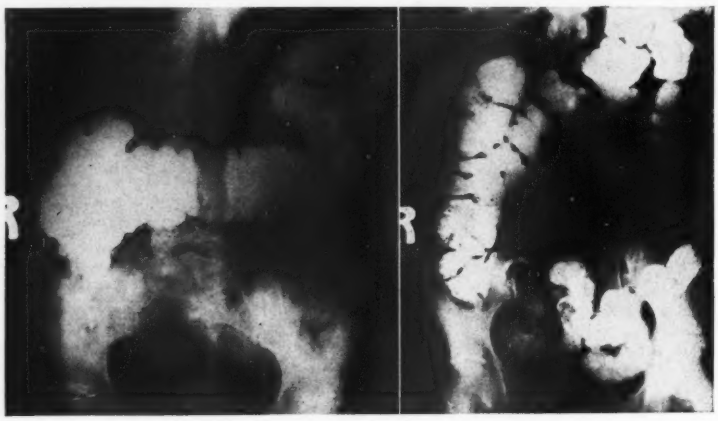


Fig. 21. Showing 72-hour retention: colonic stasis due to partial obstruction in the descending colon.

Fig. 22. Showing 48-hour retention: colonic stasis due to cancer of the rectum.

(*c*) Congenital,
(*d*) Contractive.
8. Elongated mesenteric attachments.
9. Atonic colon
(*a*) Megacolon,
(*b*) Chronic tuberculosis.
10. Diverticulosis.
11. Enteroliths.
12. Sympathetic nerve inefficiency.
13. Chronic toxic conditions
(*a*) Remote,
(*b*) Focal infection.
14. Non-rotation of the proximal colon.
15. Incompetent ileocecal valve.
16. Malignant neoplasms.

REFERENCES

1. CASE: Basic Considerations in the Roentgen Study of Intestinal Stasis. Penna. Med. Jour., June, 1915, p. 683.
2. CASE: A Critical Study of Intestinal Stasis, Including New Observations and Conclusions Respecting the Causes of Ileal Stasis. Surg., Gynec. and Obst., November, 1914, p. 592.
3. CASE: Roentgen Observations Respecting the Cause and Treatment of Constipation. Jour. Iowa St. Med. Soc., February, 1916, p. 41.
4. CASE: The X-ray Investigation of the Colon. Internat. Abs. Surg., December, 1914.
5. KANTOR, J. L.: A Clinical Study of Some Common Anatomical Abnormalities of the Colon: Redundant Colon. Am. Jour. Roentgenol. and Rad. Ther., November, 1924, p. 414.
6. SAMUEL, E. C.: Roentgenographic Interpretation of Ileocolonic Stasis. Am. Jour. Roentgenol. and Rad. Ther., September, 1923, p. 721.
7. CUNNINGHAM: Anatomy. Morrison and Gibb, 1896, London.

X-ray doses in roentgen units.—The author must be complimented on the work reported in this article because he offers very valuable information regarding the relation between physical unit and biological dose in roentgen therapy. He sent a questionnaire to a number of German roentgen laboratories that were well known for their exact dosage method and reliable observations. All their instruments had been checked against the standard calibration apparatus of Kuestner. It appeared that a good mean value for the erythema dose when using high filtered radiation as in deep therapy corresponded to 551 plus or minus 15 per cent roentgen units. A burn of first degree is to be expected at 605 *R*, one of the second degree at 660 *R*, and one of the third degree at 715 *R*. Very interesting is the comparison of the number of roentgen units required for an erythema at various wave lengths. While there seems to be no fluctuation within the range of deep therapy, a discrepancy appears in the region of longer waves. Wintz, Meyer, and Glasser find that the number of *R* required for an erythema decreases as the wave length increases. One of the most exact workers in this field, Holthusen (Hamburg), states, however, that the same number of *R*-units will produce an erythema independent from the quality 64 K.V., 6 millimeter cardboard filter, half value layer in copper 0.05 millimeter, up to 186 K.V., 1 mm. Cu. plus 1 mm. Al. half value layer in copper 1.27. He used a small field only 3×3 cm. square. In conclusion, it is suggested to base the administration of roentgen therapy on the roentgen unit measured by a well calibrated and constant ionization instrument.

E. A. POHLE, M.D.

How Many Roentgen Units Correspond to the Erythema Dose? Hans Kuestner. Strahlentherapie, 1927, XXVI, 120.

DIFFERENTIAL DIAGNOSIS OF ABDOMINAL TUMORS BY THE ROENTGENOLOGICAL METHOD

By SAMUEL BROWN, M.D.
From the Roentgenological Department of the Jewish Hospital, CINCINNATI, OHIO

A PLAIN dorsal or ventral X-ray view of the abdomen may frequently show the presence of an enlarged organ and at times even the existence of an abnormal mass, but it is often quite difficult to determine the exact organ which is involved and still more difficult to determine the origin of the abnormal mass. This difficulty arises from the fact that the density of the various abdominal structures is about the same and, therefore, offers very little shadow differentiation. Besides, several of the organs are superimposed and thus their recognition is rendered still more complicated. In order to overcome this difficulty, roentgenologists have introduced solutions or mixtures of substances of a high atomic weight into accessible organs with the purpose of rendering them more opaque than the surrounding structures. By this means one is now able to differentiate many of the abdominal structures and to study their position, shape, and size, and the relationship which they bear to one another, as well as to those organs which cannot be rendered opaque.

So far as we can learn from the literature the study of relationship between the organs of the abdominal cavity has been entirely confined to the dorsal or ventral views. This, indeed, would be quite sufficient provided the organs were all lying in one plane, but such is not the case, as we find several of the organs in two or more planes. It is evident that a knowledge of the relationship of the various organs in the anterior or posterior aspects alone is necessarily incomplete unless we also learn the relationship of any particular organ with those in front and back of it. In order to enable one to draw a correct conclusion regarding the exact state of any particular structure in the abdominal cavity, it is absolutely essential for one to familiarize himself with the relationship of each organ both in the antero-posterior and lateral aspects. For this reason a study was

Fig. 1, Case I. Anterior aspect of stomach. Duodenal bulb obscured by the pylorus.

Fig. 2, Case I. Right lateral aspect of stomach. The duodenum is distinctly visible.

Fig. 3, Case I. Left lateral aspect of stomach.

Fig. 4, Case II. Anterior aspect of colon.

Fig. 5, Case II. Lateral aspect of colon.

undertaken on normal individuals to determine the normal relationship of the organs as they are projected on the antero-posterior and lateral X-ray views. It was found that under normal conditions a constant relationship exists between the organs in the lateral view of the abdomen as it exists in the antero-posterior view; that under abnormal conditions a deviation from the normal relationship can readily be recognized. This study has resulted in the formulation of the following rule:

"An alteration in the position, shape, and size of one organ will produce an alteration in the position or shape of its neighboring organ or organs."

The word "tumor" is not used here in the restrictive sense of a newgrowth, but applies to any swelling, whether it is due to an enlarged organ or to an actual neoplasm. It is also not the intention to include in this discussion newgrowths of the gastro-intestinal tract, as it is our opinion that the recognition of such tumors is not difficult in the hands of a competent roentgenologist.

The following illustrative examples have been chosen from a large number of normal and abnormal cases to demonstrate the value of both the antero-posterior and lateral views of the abdomen in the differential diagnosis of abdominal tumors.

Case I. Figure 1 shows the anterior aspect of the stomach in the abdominal cavity. On its right side there is the shadow of the liver and on its left side that of the spleen. Above, it is limited by the lesser curvature and below by the greater curvature. Figure 2 shows the right lateral aspect of the stomach. The anterior wall of the descending portion of the stomach is moderately convex and faces the anterior abdominal wall. The posterior wall of the stomach is directed toward the spine and its contour is slightly concave. The ascending portion consists of the pylorus and duodenal bulb and is located between the descending portion of the stomach and the spine, with the descending portion of the duodenum in-

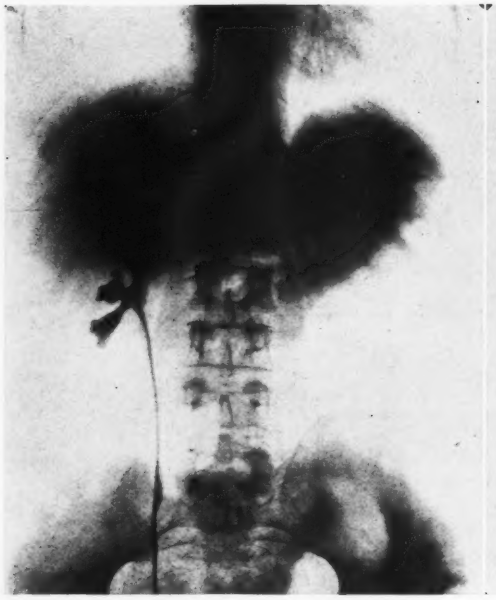


Fig. 6, Case III. Anterior aspect of kidney and ureter.

Fig. 7, Case III. Lateral aspect of kidney and ureter.

tervening. The shadow of the pancreas cannot be differentiated, but we know it occupies a definite space and that space is between the posterior wall of the stomach and the spine. We also know that the head of the pancreas is surrounded by the duodenum. With a knowledge of the exact relationship which exists between the pancreas, stomach, and duodenum we can readily infer as to the state of the pancreas. Attention is called here to the distinct visualization of the duodenum in the right lateral view, which is entirely obscured in the anterior view. This is often the case in the "steer-horn type" of stomach, where the duodenal bulb is entirely obscured by the pylorus. Figure 3 represents the left lateral aspect of the stomach, the position in this view being more or less oblique. The upper pole is directed upward and backward. The lower pole is directed downward and forward. The triangular shadow in front of the anterior wall of the stomach is that of the liver. The posterior wall faces the spine and its surface is usually somewhat convex. The duodenum in this position is not visualized. It has been found that in normal individuals the left lobe of the liver, though it overlaps the anterior wall of the stomach in the right lateral position, does not produce any depression on its wall. The same is true of the spleen in relation to the posterior wall of the stomach in the left lateral position.

Case II. Figure 4 shows the anterior aspect of the colon. Notice the relation of the hepatic flexure with the liver and the splenic flexure with the spleen. Figure 5 presents the lateral view of the colon. Notice the position of the ascending portion and the cecum, which lie behind the anterior wall of the abdomen. The transverse portion of the colon begins in front at the hepatic flexure and takes an upward and backward course, joining the splenic flexure in the region of the spine. The descending

Fig. 8, Case IV. Normal stomach and duodenum, which are slightly displaced to the left.

Fig. 9, Case IV. Right lateral view. Anterior wall of stomach is depressed backward.

portion overlaps the spine in its downward course. The above case represents the average normal individual.

Case III. Figure 6 shows the anterior aspect of the kidney and ureter; Figure 7, the lateral aspect of the kidney and ureter. It is to be noticed that both the ureter and kidney overlap the spine.

Case IV. Figure 8 shows a normal stomach and duodenum which are slightly displaced to the left. Figure 9 shows the right lateral view of the stomach, which presents

Fig. 10, Case V. Stomach and duodenum are displaced to the right.

Fig. 11, Case V. Left lateral view. The posterior wall is depressed forward.

Fig. 12, Case V. The splenic flexure is displaced downward.

Fig. 13, Case VI. Stomach and duodenum are displaced to the right.

Fig. 14, Case VI. Splenic flexure is in normal position.

a marked depression of its anterior wall in its upper half. A backward displacement of the stomach will be produced by a mass in front of it. Since the left lobe of the liver is found in this region it was natural to interpret this finding as a result of enlargement of the liver. The operative finding was carcinoma of the liver.

Case V. Figure 10 shows displacement of the stomach and duodenum to the right

Fig. 15, Case VII. Stomach and duodenum are displaced to the left.

Fig. 16, Case VII. Stomach and duodenum are displaced forward.

Fig. 17 (illustration from another case). Stomach is displaced to the left and duodenum to the right.

Fig. 18, Case VIII. Normal stomach and duodenum in normal position.

Fig. 19, Case VIII. Right lateral. Pylorus and duodenum are displaced forward.

side. Figure 11 shows the left lateral aspect of the stomach, whose posterior wall is depressed forward. This may be due to one of two things, either a large spleen or a large left kidney. Figure 12 shows the splenic flexure displaced downward; therefore, the roentgenological interpretation was a large spleen, because, in case of a large left kidney, the splenic flexure always remains in its normal position. A gland removed from the neck was proven to be that of Hodgkin's disease. The association of Hodgkin's disease with splenic enlargement is, of course, well known.

Case VI. Figure 13 shows the anterior aspect of the abdomen. The stomach and duodenum are displaced to the right, as in the previous case, but here the splenic flexure is in normal position, as shown in Figure 14. The roentgenological interpretation was that of a large left kidney. The subsequent examination by a urologist, and operation, proved it to be a pyonephrosis with ureteral obstruction.

Case VII. Figure 15 shows displacement of the stomach and duodenum to the left; Figure 16, a forward displacement of the pylorus and duodenum. Such a condition will be produced by a large right kidney or tumor of the pancreas. The X-ray interpretation was that of a large right kidney because of the fact that in this case both the stomach and duodenum were displaced to the left. In case of tumor of the pancreas, if any lateral displacement does take place, the stomach and duodenum are displaced in opposite directions; that is, the stomach is displaced to the left and the duodenum to the right. (See Figure 17.) The urological examination and operation proved this to be a case of a large hydronephrosis.

Case VIII. Figure 18 shows a normal stomach and duodenum, in normal position. Figure 19 shows the right lateral aspect of

Fig. 20, Case IX. Normal stomach and duodenum in normal position.

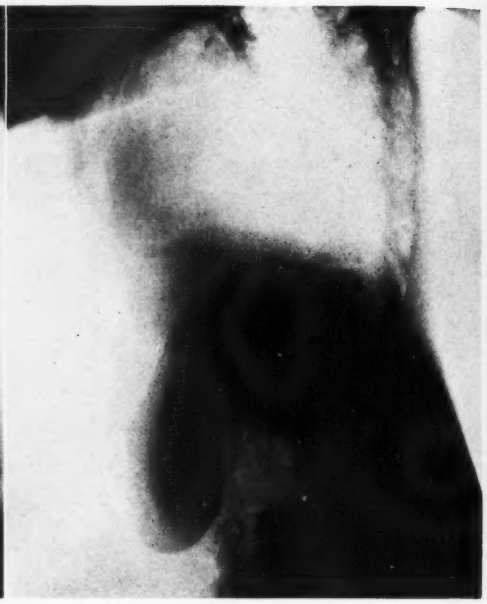


Fig. 21, Case IX. Right lateral position. Pylorus and duodenum are displaced forward. Descending portion is deformed.

the stomach. The pylorus and duodenum are displaced forward. The roentgenological interpretation was that of a retroperitoneal tumor, apparently arising from the pancreas. The operative findings were a newgrowth in the pancreas and metastasis in the liver.

Case IX. Figure 20 shows, again, a normal stomach and duodenum, in normal position. The right lateral view (Fig. 21) shows forward displacement of the pylorus and duodenal bulb. The descending portion of duodenum is deformed. Fluoroscopically there was observed increased peristalsis with very slow emptying. On the plain view the gall-bladder shadow was found very much enlarged. The roentgenological interpretation was that of a tumor at the head of the pancreas producing partial obstruction of the descending portion of the duodenum and common bile duct. The operative findings fully confirmed the X-ray interpretation. It may here be added that in the last two cases no palpable masses were discovered on physical examination.

Case X. Figure 22 shows a normal colon in normal position. The lateral view (Fig. 23) shows backward displacement of the cecum and ascending colon. The roentgenological interpretation was that of an intra-abdominal mass and not that of a retroperitoneal mass, which was suspected on physical examination. The operation proved it to be intra-abdominal.

Case XI. Figure 24 shows upward displacement of the left kidney, the ureter displaced to the right. On the lateral view (Fig. 25) the ureter is seen to be displaced forward. The roentgenological interpretation was that of a mass in the left retroperitoneal region but not arising from the kidney. Operation proved it to be a large retroperitoneal abscess containing a piece of

Fig. 22, Case X. Colon in normal position.

Fig. 23, Case X. Lateral aspect. The cecum and ascending portion are displaced backward.

Fig. 24, Case XI. Kidney is displaced upward. The ureter is displaced to the right.

Fig. 25, Case XI. Ureter is displaced forward.

surgical gauze apparently left over from a previous operation.

The illustrations aim to convince that, with a knowledge of regional anatomy of the abdomen and its roentgenological demonstration in the antero-posterior and lateral aspects, it is possible to make a correct localization of any abnormal mass in the abdomen and determine its probable origin. It was also shown in the case of the pancreas, which is physically inaccessible to direct examination, that it is possible to recognize moderate enlargement of this organ by means of the antero-posterior and lateral views. No attempt was made to determine the exact nature of the growth or enlargement, but its exact location and probable origin served a useful function in directing the surgeon to institute the proper surgical procedures.

CARCINOMA OF THE CERVIX: TREATMENT BY A COMBINATION OF ROENTGEN RAYS, RADIUM, AND ELECTROTHERMIC COAGULATION[1]

By J. THOMPSON STEVENS, M.D., MONTCLAIR, NEW JERSEY
From the J. Thompson Stevens Clinic for Radiation Therapy and Electrothermic Coagulation

AT the Mayo Clinic it is felt—and the opinion has been expressed—that in its earliest stages carcinoma of the cervix is so simple to eradicate by means of radiotherapeutic methods that little else is necessary, and that in its later stages no other method of treatment can hope to accomplish anything. This is at present the consensus of opinion of surgeons and radiotherapists in this country and likewise abroad. Therefore, during the past few years the numbers of patients treated for cervical carcinoma by radiation therapy have been steadily increasing in all radiotherapeutic clinics. Recently a surgical friend told me personally that he never expected to operate on another cervical cancer because his results with radiation therapy had so frequently exceeded his expectations. And so I wish to express my appreciation and thanks to our President, for having invited me to discuss with you so important a subject.

PATHOLOGY OF CERVICAL CARCINOMATA

Cancer of the cervix occurs in two varieties: (1) Squamous-cell carcinoma and (2) adenocarcinoma.

Squamous-cell carcinoma is the more frequent type. In the beginning the primary lesion is found to start from the squamous epithelium covering the mucous membrane of the vaginal portion of the cervix.

Adenocarcinoma starts within the cervical canal from one of two sources: (*a*) from the cylindric epithelium covering the mucosa of the canal or (*b*) from the glands of the cervix.

Squamous-cell carcinoma is the less malignant of the two types. It is, however, the more frequent in occurrence. Its growth is slower than adenocarcinoma, but it is more resistant to irradiation. Therefore, one can conclude that squamous-cell carcinoma must receive a somewhat larger dose of the radiations than is necessary in adenocarcinoma, that life may be longer even though only palliation is obtained from treatment, and that while symptoms are more easily cleared up by a smaller dose of the radiations in adenocarcinoma, recurrence is more apt to be the rule, and results in the end are not so likely to be satisfactory.

Stenosis of the cervix with pyometra is a more frequent complication following the treatment of carcinoma of the cervical canal than is the case when the disease is located within the vaginal portion of the cervix.

CLASSIFICATION OF CARCINOMATA

In 1920 Henry Schmitz presented a new classification for the study and treatment of carcinomata. This classification has since been accepted by many workers in various parts of the world. Your essayist was one of the first to use the new classification and placed himself on record at the California meeting of this Society in 1923. The new classification is based upon facts as they are found in the individual patient. The old terms "operable" and "inoperable" can no longer be used by the careful worker. As you know, the term "operable," as applied to an individual case, often varied or was changed to "inoperable" upon consulting a second surgeon. These terms are too elastic. Whether or not a case is actually

[1]Read by title at the Twelfth Annual Meeting of the Radiological Society of North America, at Milwaukee, Nov. 30, 1926.

operable depends upon the skill of the particular surgeon who sees the case. An operable carcinoma to one surgeon might be absolutely inoperable to one less skillful, and in this way it would be impossible for anyone to draw any conclusions whatever as to the relative merits of any of the various methods of treatment. The Schmitz classification is so clear and to the point that misunderstanding as to what one means is impossible. It is:

Class 1. Localized. In this class the growth is absolutely localized to the cervix.

Class 2. Doubtfully localized. Cases showing bogginess of the tissues about the cervix.

Class 3. Cases with induration of the contiguous tissues and organs.

Class 4. Cases with cachexia, frozen pelvis, definite metastasis, etc.

Class 5. Recurrent cases.

extent of the involvement made it impossible. So far as can be told from examination this patient appears to be perfectly well and is able to do all of her household duties, which include the family washings. This case is one of three treated by a combination of radiation and operation, two of the cases getting nothing more than palliation. Personally, I should like very much to see this plan carried out on a large number of these hopeless cases, because I feel that it has very definite advantages over either surgery or radiation alone.

Another case reported to you in detail three years ago has been perfectly well for four years lacking two months. This patient is not included above because she had an abdominal section followed by closure, without anything being done except postoperative roentgen and radium therapy, because of the hopelessness of the condition found.

TABLE I. RESULTS OF THE TREATMENT OF CERVICAL CARCINOMATA BY MEANS OF IRRADIATION AND ELECTROTHERMIC COAGULATION

Year	1918	1919	1920	1921	1922	Total	Number of recoveries	Per cent of recoveries
Group 1	1	1	2	4	6	14	14	100
Group 2	3	3	5	2	8	21	9	42.1
Group 3	1	3	2	6	15	27	3	11.3
Group 4	1		7	4	5	17	0	0.0
Recurrent			1		2	3	1	3.3
						82	27	32.7

Examination of Table I shows that the best time to treat carcinoma of the cervix is early. If treatment can be thoroughly carried out in Group 1, while the disease is still localized to the cervix, practically all cases should recover; Group 2 gives less than 50 per cent; Group 3 about 10 per cent, and Groups 4 and 5 practically no recoveries.

November 12, 1926, a patient who had been treated five years and one month previously was again seen. The case is not included above because it was treated by a combination of surgery and radiation. It was reported in detail to you three years ago. The patient had had an abdominal section, ligation of the sacramedian, internal iliac, and ovarian arteries. No attempt had been made to remove the uterus because the

Examination of Table II shows, as might be expected, that the combination of roentgen and radium rays produces improved results clinically. The radiotherapist has for years pleaded with everyone interested to combine the use of radium and the roentgen rays in the treatment of these cases. He had only physical measurements of rays to set up as his argument. Now he has the same physical measurements of rays to look back to, plus these improved results. In only one instance do the radium treatment results approach those of the combined methods of treatment. Kehrer shows 27.8 per cent of cured cases with radium treat-

ment only. The reason for this fact is that the majority of his cases presented themselves for treatment early. The exact percentage of early cases treated by each worker is found in Table III.

My own figures agree with those of Schmitz in Group 1. In Group 2 there is the slight difference of 2.1 per cent; in Group 3 the difference is only 1.3 per cent, and in Group 4 they agree. This is due to the fact that more of my cases are included in Groups 1 and 2; also, no doubt, to improvements in apparatus and technic, thus giving me a distinct advantage, since my work was done from 1918 to 1922, whereas Schmitz worked from 1914 to 1918. These two periods represent vast contrasts in technic. Since 1922, with further improvements in apparatus and technic, my own figures are slightly better. I have learned indirectly from Schmitz that his figures are much improved over those already published.

Examination of Table III shows that the radiotherapist is working with the majority of patients who belong to the third, fourth, and fifth classes, *i.e.*, the unfavorable cases. However, the radium therapists show, with the exception of Kehrer, an average of 8.9 per cent of cures, with a localization percentage of 28.2 per cent. The cases treated by roentgen and radium rays, with a localization of 33.3 per cent, show 13.9 per cent cures, and my own figures of cases treated with roentgen and radium rays and electrothermic coagulation, with a localization percentage of 42.5 per cent, show 32.7 per cent cures for five years or longer. The surgical results, with a localization of 62.2 per cent, show 23.9 per cent cures.

Kehrer shows 27.8 per cent cures with radium only. Examination of Table III shows that his results are with a localization of 45.7 per cent, as compared with the other workers' percentage of localization of 8.9 per cent. This explains thoroughly his high percentage of cures. In my own case, with

TABLE II. COLLECTIVE STATISTICS OF THE RESULTS IN CERVICAL CARCINOMATA TREATED BY RADIUM OR BY RADIUM AND ROENTGEN RAYS

	Years	Group 1			Group 2			Group 3			Group 4			Total			Method of treatment
		Number	Living	Per cent	Number	Living	Per cent	Number	Living	Per cent	Number	Living	Per cent	Number	Living	Per cent	
Clark	1914-1918	....	....	....	22	6	27.2	....	....	....	118	6	6.7	140	12	8.6	Radium
Bailey and Healy	1914-1917	11	3	27.2	23	6	261	....	....	....	121	8	6.6	155	17	9.2	Radium
Kehrer	1915-1917	19	11	58	40	13	30	....	....	....	70	12	17	129	36	27.8	Radium
Döderlein	1912-1918	110	48	43.6	136	31	22	340	23	6.7	169	1	.65	755	103	13.2	Radium, X-ray
Baisch	1914-1917	62	18	29	39	6	15.4	90	4	4.4	7	0	00	198	28	14.1	Radium, X-ray
Schmitz	1914-1918	3	3	100	15	6	40	60	6	10	25	0	00	103	15	14.6	Radium, X-ray
Stevens	1918-1922	14	14	100	21	9	42.1	27	3	11.3	17	0	00	82	27	32.7	Radium, X-ray. Coagualtion
Total														1562	338	21.9	

TABLE III. SHOWING HOW PERCENTAGE OF LOCALIZATION OF THE CARCINOMA INFLUENCES RESULTS

	Localization per cent	Total number	Number cured	Per cent of cures	Method of Treatment
Clark	17.0	140	12	8.6	Radium
Bailey and Healy	22.0	155	17	9.2	Radium
Kehrer	45.7	129	36	27.8	Radium
Döderlein	32.6	755	103	13.2	Radium and roentgen rays
Baisch	51.0	198	28	14.1	Radium and roentgen rays
Schmitz	17.5	103	15	14.6	Radium and roentgen rays
Stevens	42.5	82	27	32.7	Radium, roentgen rays, and electrothermic coagulation
Johns Hopkins	52.1	381	102	26.6	Surgery
Stoeckel	70.6	350	98	26.6	Surgery
Graves	64.0	181	34	18.5	Surgery

a percentage of localization of 42.5 per cent, a few points less than Kehrer, the use of radium and roentgen rays and electrothermic coagulation gives a better percentage of results than his. As can be seen, the surgical results, with a much higher percentage of localization, are not as good as those treated by the three agents.

ROENTGEN TREATMENT

Whenever possible, it is probably best to begin treatment with a thorough irradiation of the pelvic contents with the roentgen rays. Using not less than 200 K.V., the time duration of the exposure over each port, together with the number of ports necessary, is determined by measurements of the patient's pelvis, and of the radiations by means of the iontoquantimeter. The applied dosage is 170 *e*-units to the cervix and all of the pelvic lymphatics draining the uterus and cervix. My erythema skin dose is 200 *e*-units. This entire treatment is repeated in two weeks' time.

ELECTROTHERMIC COAGULATION

Upon completion of the second series of roentgen treatments, the disease upon or within the cervix is destroyed and removed by means of electrothermic coagulation. This is a surgical operation and the term "electrothermic coagulation" at once conveys to one's mind that there is a production of heat by an electric current of sufficient intensity to coagulate the tissue to which it is applied. The operating electrode is cold at all times, the heat appearing only in the tissues treated, and being caused by the oscillations of a high frequency current, the applicator in general being a pointed instrument. As compared with excision, it has the enormous advantage of *destroying the malignancy before it is removed.* It is impossible to overestimate the value of the fact that with coagulation the growth is removed as a dead mass of tissue instead of as a mass of viable cells. This, plus the fact that the lymphatics and blood vessels are closed, tends to remove the possibility of mechanical metastasis. Heat develops in the tissues treated because of their resistance to the flow of current. Therefore, it is progressively more penetrating the larger the amount of current used and the longer it is applied. The actual cautery, as we all know, rapidly heats to a very high temperature the tissues to which it is applied, the tissues becoming charred if treated long enough. But the actual cautery does not produce sufficient heat deep within the tissues, and, therefore, the results in the treatment of malignant lesions with the actual cautery fail to compare with those obtained by means of electrothermic coagulation. Electrothermic coagulation, like other operations, is painful and is done under a general anesthetic, generally gas and oxygen—never ether.

RADIUM THERAPY

As soon as the carcinoma is destroyed and

removed, radium in the form of needles is buried deeply and evenly throughout the coagulated area and the cervical stump. If five-milligram needles are used, they are placed one centimeter apart; if ten-milligram needles are used, they are placed two centimeters apart. Finally, a radium capsule of not less than fifty milligrams is pushed through the cervix into the uterus. The operation is completed by tightly packing the vagina with gauze.

ROENTGEN THERAPY

From four to eight weeks following the coagulation and radium treatment further roentgen treatment is given. Rays of high voltage are used again, exactly in the manner already described. Then the follow-up period of five years, if possible, is undertaken.

CONCLUSIONS

1. The foremost surgeons agree that carcinomata of the cervix are best treated by radiotherapeutic methods.

2. The pathology of cervical carcinoma is presented briefly, squamous-cell carcinoma being the most resistant to irradiation and the most frequent in occurrence. Adenocarcinoma is the least resistant to treatment and not so frequent in occurrence.

3. The Schmitz classification is presented, together with the reasons for its adoption.

4. Results of the treatment of 82 personal cases with roentgen rays, radium, and electrothermic coagulation are tabulated. Reported cases were treated prior to January, 1923.

5. Collective statistics from various clinics throughout the world are tabulated, showing the results of the various workers in the treatment of cervical carcinomata with radium alone and with radium and the roentgen rays combined.

6. A third table is included to show how the promptness of patients in presenting themselves for treatment early in the course of the disease influences end-results. The earlier a case is treated, of course, the better the end-result.

7. A brief discussion of the treatment of cervical carcinoma by means of roentgen rays, radium, and electrothermic coagulation is presented.

BIBLIOGRAPHY

1. SCHMITZ, HENRY: The Relation of the Science of Physics to Radiation Therapy. Am. Jour. Roentgenol. and Rad. Ther., August, 1921.
2. SCHMITZ, HENRY: The Classification of Uterine Carcinoma for the Study of the Efficacy of Radiation Therapy. Am. Jour. Roentgenol., August, 1920.
3. SCHMITZ, HENRY: End-results of the Treatment of Cervical Carcinoma with Radium and Roentgen Rays. Jour. Am. Med. Assn., January 10, 1925.
4. PFAHLER, GEORGE E.: Electrothermic Coagulation and Roentgen Therapy in the Treatment of Malignant Disease. Surg., Gynec. and Obst., December, 1914.
5. STEVENS, J. THOMPSON: The Management of Malignancy by Combined Methods. Med. Rec., November 13, 1920.
6. STEVENS, J. THOMPSON: The Treatment of Malignant Disease of the Cervix with the New Higher Voltage, Shorter Wave Length Roentgen Rays, Radium, and Electrothermic Coagulation. RADIOLOGY, November, 1923.

CHRONIC OSTEITIS SIMULATING OSTEOGENIC SARCOMA

CASE REPORT

By HENRY K. TAYLOR, M.D.
From the Roentgen-ray Department, Beth David Hospital, New York City

THE difficulties sometimes encountered in the diagnosis of bone lesions, when the productive phase predominates, is illustrated by the following case. Here a localized chronic inflammatory condition, because of the prominence of the productive changes, was mistaken for an osteogenic sarcoma.

The patient is a female, age 27, single. She was admitted to the Beth David Hospital, April 4, 1927, with the chief complaint of a painful swelling above the left ankle joint. She stated that the present illness began in February, 1924, when she tripped and fell down five or six steps, inverting the left foot and injuring her left ankle, which required practically no attention, other than rest and external applications for about ten days. Subsequent to this she resumed her usual occupation of household duties. Twenty-two months later, in December, 1925, the patient began to complain of pain slightly above the left ankle, which she characterized as simulating a severe toothache. This was constant—no radiation, not influenced by walking, constantly getting worse, and relieved by hypnotics. Hypnotics were necessary so that she could obtain sleep. At this time there was also noted a swelling above the ankle, which appeared to increase in size after walking. For a period of two months she was treated by a physician (in Hungary) for rheumatism, and obtained no relief. She consulted several other physicians without obtaining relief. A radiographic examination was finally made April 5, 1926, five months after the onset of symptoms (twenty-six months after the injury), by Dr. Eugen Schwartz Jenö, Aradea-Mare, Nagyvard, and a translation of the report is as follows: "On the tibial side of the distal third of the fibula there is a large periosteal thickening which is not completely calcified or fused with the cortex. The surface of the periosteal elevation is smooth. On the lateral side of the fibula there is a fine periosteal proliferation. The tibia shows a normal structure. Diagnosis: Periostitis, traumatica?"

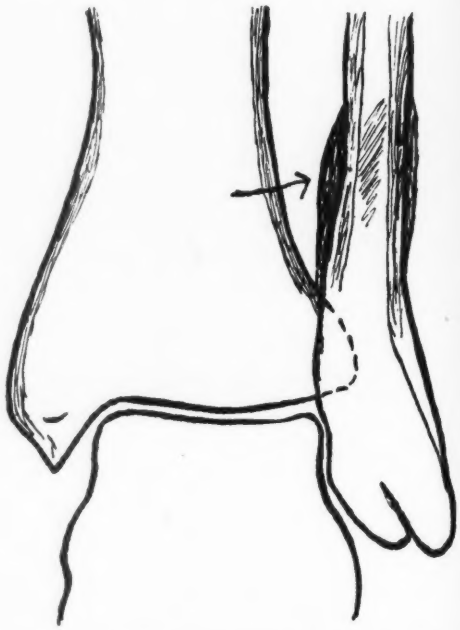


Fig. 1. Tracing of illustration which accompanied the report of the examination made April 5, 1926, showing the periosteal thickening.

Wassermann test was negative.

The patient arrived in the United States, April 30, 1926. In June, 1926, another radiographic examination was made at the New York Infirmary for Women and Children, and reported as chronic periostitis. Wassermann test was again negative. Conservative treatment was advised for a short time, and, if no relief of symptoms, opera-

Fig. 2. Radiographic appearance March 23, 1927. Marked progression of lesion, with localized area of bone destruction.

tion suggested. She went to Detroit, where conservative treatment was advised and instituted, which in the main consisted of exposure to ultra-violet rays three times a week for a period of five months, with no relief of symptoms. Wassermann test here was also negative.

At this time the local condition presented a small elevation of the soft tissues over the lower end of the fibula, with local tenderness. There was no redness or local heat. There was some swelling of the soft tissues about the ankle joint. The pain persisted and was still characterized as like a severe toothache, uninfluenced by walking. The patient was able to walk without any difficulty. Her general condition was good. She had to resort to large doses of aspirin (25 gr.) in order to obtain some sleep. No history of elevation in temperature at any time. The patient had lost about thirty pounds in weight during the past five or six months.

March 23, 1927, she was referred to the X-ray Department for examination of the left ankle. The roentgenogram showed a lesion involving the lower end of the shaft of the fibula. This appeared to be due to an osteal and periosteal proliferation, invading the soft tissues. The mass was homogeneously dense, except for a small localized area of decreased density in the center, and showed no other destructive changes. These findings suggested a sclerosing osteogenic sarcoma. The central area of decreased density was thought to be due to a central necrosis.

In addition to this there was a thickening of the periosteum along the outer surface of the lower end of the shaft of the tibia. Ra-

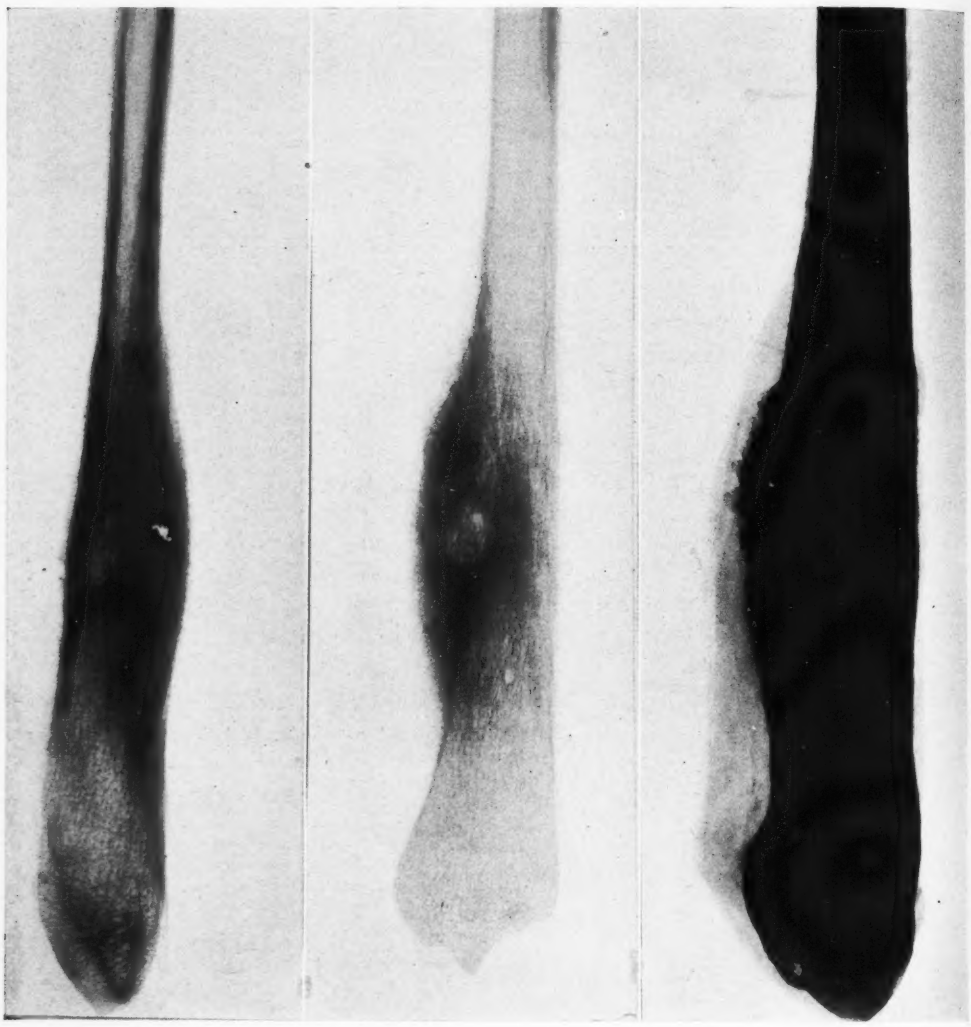


Fig. 3. Roentgenogram of the excised fibula. Over-exposed illustration shows the periosteal changes.

diographic examination of the entire body showed no evidences of pulmonary or skeletal metastases.

The findings seemed atypical and a bone abscess might produce such bony changes. The films were submitted to Dr. C. Gottlieb for diagnosis. It was his opinion that it was an osteogenic sarcoma.

The history of the case and the radiographs were then forwarded to Dr. E. A. Codman, of Boston, for his opinion. On March 30, 1927, Dr. Codman forwarded a statement which in part is as follows: "The history and films leave no doubt in my mind that it is a case of osteogenic sarcoma. One might call it of the sclerosing type and therefore hope for a somewhat better prognosis than usual, but my experience leads me to doubt whether this type is much less rapid in its course. . . . The rate

of growth seems fairly rapid, by comparison of the first and last plates, and no more time should be lost."

April 4, 1927, the patient was admitted to the surgical service with a diagnosis of osteogenic sarcoma of the left fibula.

Physical examination showed a well developed and well nourished young woman, not acutely ill, and revealed no abnormal findings except for the local condition above the left ankle. On the lower third of the left leg over the shaft of the fibula there was a hard firm mass with a localized point of tenderness. The mass was oval in shape, measured approximately three inches in length and one and one-half inches in width. The elevation was not marked. The edges of the tumor mass were clearly defined. The overlying skin was freely movable, not attached to the mass, and not discolored. No local heat.

The white and differential count showed 8,800 white cells, with 72 per cent polymorphonuclears and 28 per cent small and large lymphocytes. The urine examination showed a faint trace of albumin with numerous white cells, otherwise negative.[1]

April 5, 1927, the patient was operated on, and the entire left fibula was removed by Dr. L. Miller Kahn. No fixation or stabilizing operation for the ankle joint was performed. It was decided to leave this for some future time.[2]

The excised fibula was sent to Dr. James Ewing for examination, and he reported chronic osteitis.

All the information to date was collected, including the radiographs and a slide of the tumor mass, and forwarded to the Sarcoma Registry, where it was given No. 802, and tentatively diagnosed as an osteogenic sarcoma.

A portion of the specimen was later submitted to Dr. M. Goldberg, pathologist, Beth Israel Hospital, New York City, and he reported as follows: "Section appears to be spongy bone which is arranged in lamellæ, said lamellæ containing here and there granulation tissue. There can also be seen areas of fibrous tissue carrying blood vessels with markedly thickened walls. On one side of the bone formation we find chronic inflammatory tissue with some cellular infiltration. The cells are mostly mononuclears, plasma and mast cells. In one of the sections was also found a great number of polynuclear cells which would indicate an acute inflammatory process. Diagnosis: Acute and chronic periostitis."

The post-operative course in the hospital was uneventful and the patient was discharged as improved May 12, 1927.

Since the patient's discharge from the hospital her general condition has been good. She shows considerable improvement and is gaining weight. The pain is gone. She is able to sleep without medication. She can walk with the aid of crutches, but only for short distances—one or two squares. She cannot account for this for she has no pain on standing or walking. This difficulty we feel is due to the instability of the left ankle joint, which can be overcome by a stabilizing operation.

A roentgenographic examination of the entire body four months after the operation showed no pulmonary or skeletal metastases. The left ankle showed the periostitis of the tibia which was present prior to the removal of the fibula. No other abnormal findings except for the absence of the fibula.

COMMENT

In an analysis of the history we have the following evidence in favor of a new-growth:

---

[1] A blood count taken March 27, 1927, showed the following: Hg. 75 per cent, red cells 4,024,000, white cells 8,050, polymorphonuclears 73 per cent and 27 per cent lymphocytes. Urine examination at this time showed a trace of sugar, sp. gr. 1,034, otherwise negative.

[2] On this same date we received another letter from Dr. Codman which pertained to the Sarcoma Registry, and also mentioned that Dr. James Ewing would be interested in the specimen.

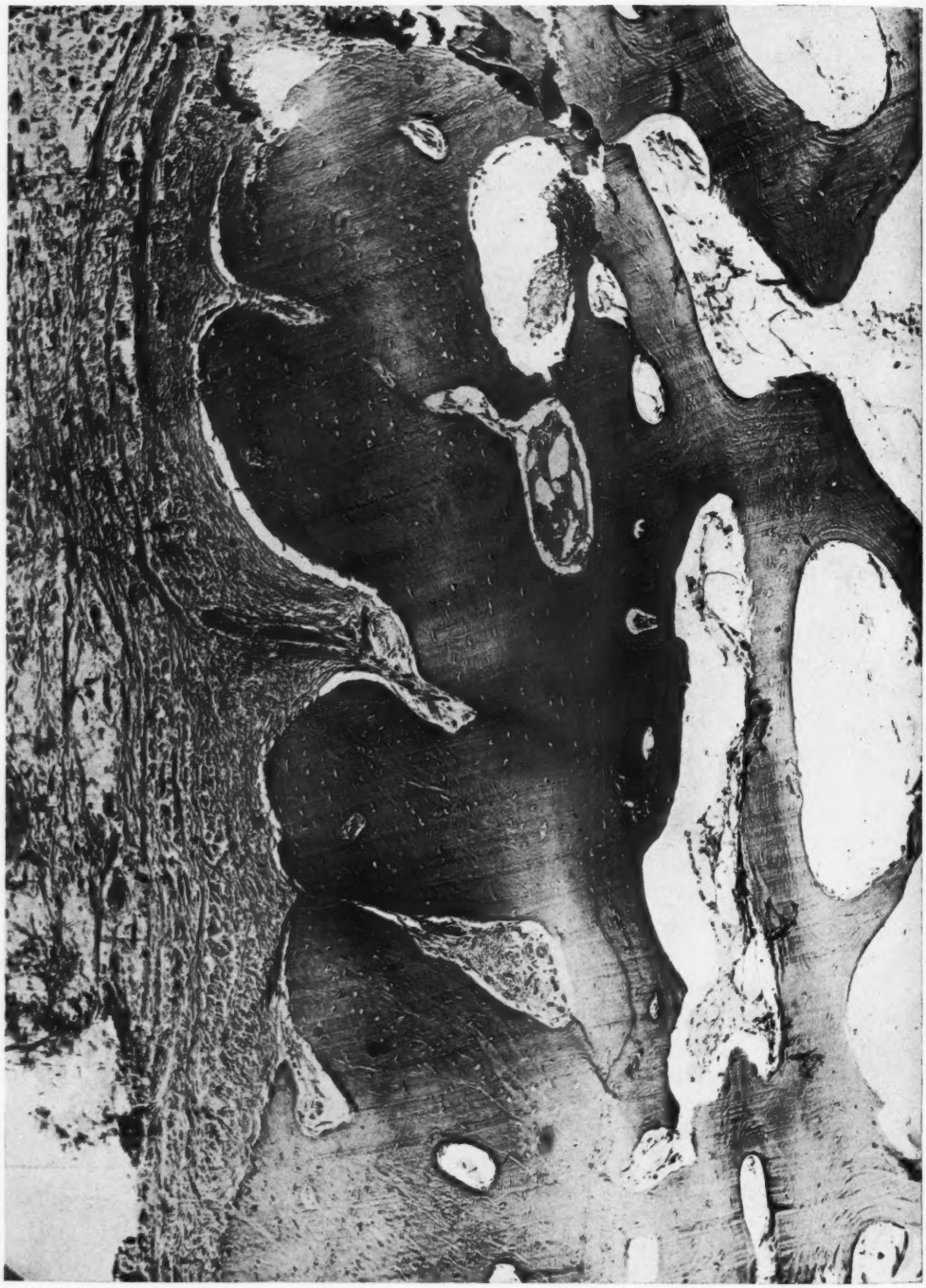


Fig. 4A (low power). Spongy bone arranged in lamellæ containing granulation tissue. Chronic inflammatory tissue with cellular infiltration, mostly mononuclears, plasma cells, and mast cells.

1. The age of the patient. This is within the sarcoma period.

2. A history of trauma. Trauma is claimed by some to be an etiological factor of bone tumors. In this particular instance the trauma probably was the cause of the lesion. In the majority of instances, trauma, *per se*, has no bearing on the etiology, merely focusing our attention on an existing lesion.

3. The long interval of time (twenty-two months) from the date of the trauma to the onset of the symptoms. There is no doubt but that bone changes were taking place prior to the onset of symptoms.

4. During the interval of time between the original radiograph taken in April, 1926, and the last one in March, 1927, a period of eleven months, there were marked and progressive changes.

5. *Symptoms:* The presence of a mass, associated with a definite history of loss of weight. The persistent severe pain. There was no febrile disturbance during the entire course of the ailment. The blood counts showed no evidences to indicate the presence of an infection, nor did the clinical history or physical examination.

On the other hand, the age and etiological factor of trauma fit in well with an inflammatory process. The course of the disease is that of a low-grade infection, giving no systemic symptoms or blood changes, being a localized area of bone destruction with periosteal proliferation, the predominating process being a sclerosis. The pain and localized point of tenderness would tend to point toward an infection. The lower end of the fibula is an unusual site for an osteogenic sarcoma.

While an infection was thought of, the appearance was not typical of a bone abscess. The only roentgenographic evidence which at all suggested an infection was the central area of decreased density within the tumor mass, and this is not an absolute indication, for necrosis can and does occur in tumors.

In general, this case calls attention to the fact that every once in a while a benign lesion will be taken for malignancy, and a radical operation instituted where it is not necessary. In this particular instance the result might have been a sad one if the surgeon had decided to do an amputation instead of an excision. Fortunately, instances of this kind, while they do occur, are the exception and not the rule.

August 17, 1927, I submitted the films taken in March, 1927, to Dr. I. Seth Hirsch for an opinion, without giving the history. His opinion was that the process was an inflammatory one, calling it a localized sclerosing osteitis, in reality a medullary abscess. He also stated that during the past year or two he had had four similar cases which closely resembled an osteogenic sarcoma. The first such case was diagnosed as an osteogenic sarcoma, was operated on, and found to be a chronic bone abscess.

On October 5, 1927, Dr. B. C. Crowell, Registrar, Committee on Bone Sarcoma, forwarded a résumé of the opinions and Diagnoses of Pathologists on Registry Case No. 802, which is as follows:

Dr. E. A. Codman, March 30, 1927. "The history and films leave no doubt in my mind that it is a case of osteogenic sarcoma. One might call it of the sclerosing type and therefore hope for a somewhat better prognosis than usual, but my experience leads me to doubt whether this type is much less rapid in its course. However, it might be, and that is good reason for considering excision of the lower two-thirds of the fibula rather than amputation.

"If I were the surgeon in the case I would attempt excision and, if I succeeded in doing it, I would ankylose the astragalus to the tibia. If, however, I found that I was cutting into evidently sarcomatous tissue I should amputate. I would not attempt to

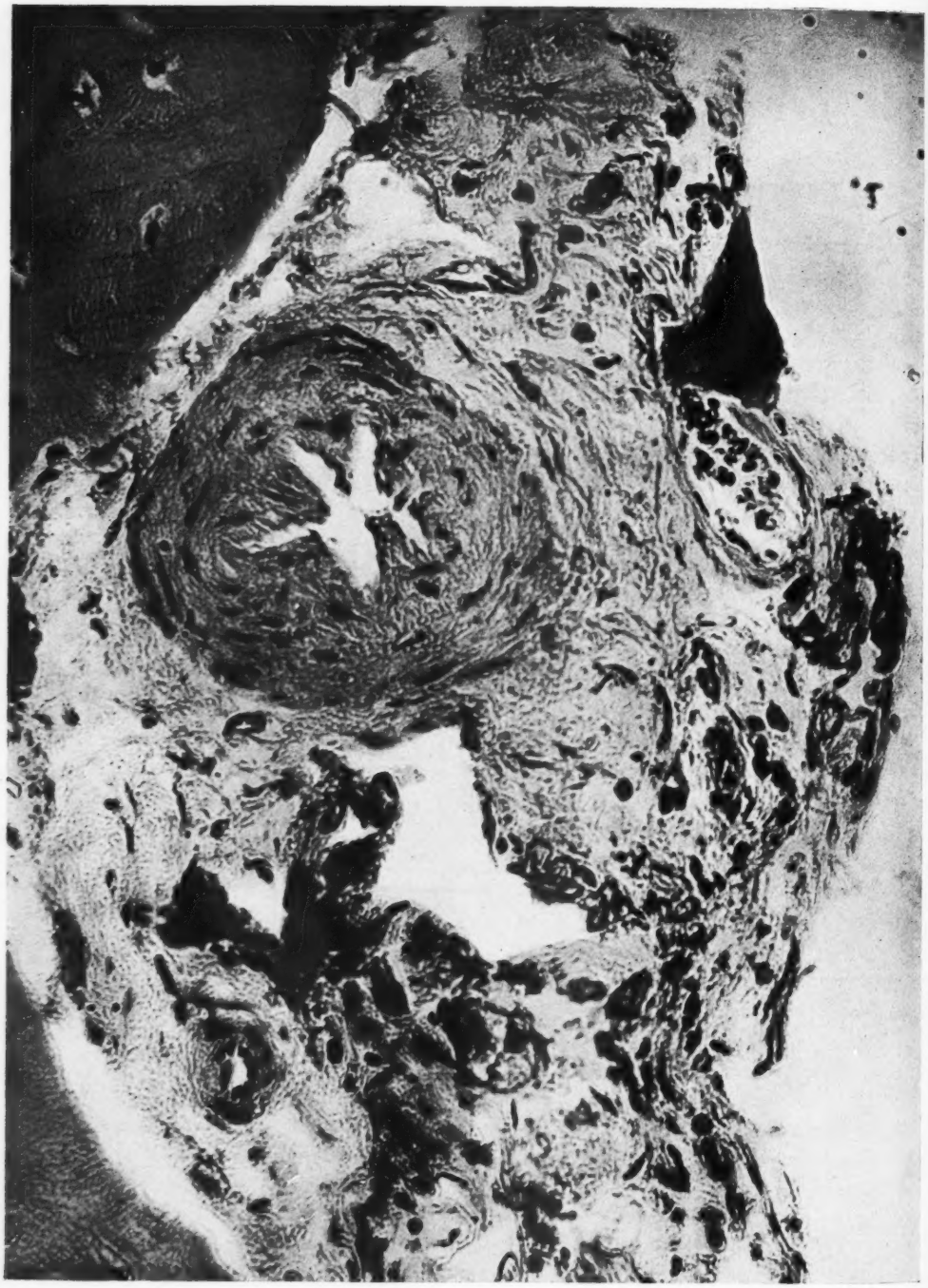


Fig. 4 B (high power). Blood vessel with markedly thickened wall due to inflammatory change.

take a preliminary specimen but excise the whole tumor if possible. The prognosis is bad in any case, and the patient will probably soon show metastases in the lungs. Even if they were present now I should advise excision, as above, for the symptomatic relief. Radium and X-ray are of no use in this type of sarcoma."

Dr. D. B. Phemister, June 11, 1927. "Localized osteomyelitis with pea-sized cavity and marked sclerosis about it. The cavity shows in all films, remaining about the same size, while new bone denser in later films. Microscopic sections show non-tumorous bone. No sign of tumor. Such lesions usually due to *Staphylococcus pyogenes aureus.*"

Dr. E. A. Codman, July 21, 1927. "On seeing sections I think Phemister's reasoning is good. I recall a case giving similar X-ray which proved to be osteomyelitis. Better sections should be furnished. I cannot be sure the few cells are inflammatory but the bone looks unlike tumor bone."

Dr. F. B. Mallory, Dr. F. Parker, Jr., and Dr. James Ewing, July 25, 1927. "Cancellous bone; no evidence of tumor."

Dr. C. C. Simmons, July 27, 1927. "Osteomyelitis."

The doctors comprising the Sarcoma Registry deserve considerable commendation for their work and the writer wishes to express his thanks and appreciation for their aid in this case.

EDITORIAL

M. J. Hubeny, M.D. . . . . *Editor*
Benjamin H. Orndoff, M.D.
John D. Camp, M.D. *Associate Editors*

Contents of RADIOLOGY copyrighted by the Radiological Society of North America.

THE PROGRESS OF STANDARDIZATION

At its summer session in 1925, the Radiological Society of North America authorized the appointment of a committee to study various phases of the problem of measuring X-rays, and to make recommendations for the guidance of the members of the Society. The President appointed E. C. Ernst, M.D., and Otto Glasser, Ph.D., as chairman and sub-chairman of the committee, and directed them to select such other practising roentgenologists and physicists to serve on the committee as seemed advisable. At the next meeting of the Society the committee made the following recommendations:

1. That measurements of X-rays be made by one of the ionization methods.

2. That the electrostatic unit be used to express intensity.

3. That quality be expressed as the effective wave length, the average wave length, the half value layer, or the coefficient of absorption.

The recommendations were adopted by the Society until such time as international units and standards shall be agreed upon. At the present time, therefore, members of the Society and contributors to Radiology should express the *intensity* of both the skin and depth doses in terms of electrostatic units. They should express *quality* in one of the four ways mentioned in the foregoing paragraph.

The members of the committee believed that the United States Bureau of Standards could aid most effectively in the solution of many of their problems. On visiting the Bureau of Standards they learned that a definite program looking toward the standardization of methods of measuring X-rays had been planned several years ago, but had not been carried out on account of the lack of available funds. However, at its last session Congress appropriated sufficient money for the necessary equipment and salaries, and work on the program is now being done.

During the Washington convention of the American Medical Association, the standardization committees of the Radiological Society of North America and the American Radium Society, and a representative of the American Physical Society, met informally with Dr. Franklin L. Hunt, who has had charge of the X-ray work at the Bureau of Standards. Dr. Hunt said that the electrostatic unit had been accepted by the United States Bureau of Standards as the official national unit of X-ray intensity. He and other officials of the Bureau have written a new definition of the unit which agrees with the *R*-unit as defined by Dr. Behnken, of the German Reichsanstalt, in every particular with the exception of a minor change in the method of correcting for variations in temperature.

Dr. Hunt and the director of the Bureau, Dr. George K. Burgess, outlined the contemplated activities of the Bureau as follows:

1. To design and construct instruments

for the measurement of X-ray intensity to be kept in the Bureau as a primary standard.

2. To construct less sensitive, more rugged portable instruments, as secondary standards, and to train men in their use in the field so that the output of X-rays from various apparatus throughout the country can be calibrated in terms of absolute units.

3. To calibrate measuring instruments in absolute units for manufacturers.

4. To test the efficiency of various types of apparatus and tubes used in producing X-rays.

5. To study methods of protection against stray radiation under actual working conditions.

6. To study the efficiency of various protective materials, such as lead rubber, lead glass, and barium plaster.

7. To develop the possibilities of the use of X-rays in the industries and arts.

With the Bureau of Standards lending its support, and with the help so generously being given by many physical laboratories throughout our country, it seems that the solution of the physical part of the standardization problem is in sight. The correlation of physical and biological effects will require prolonged study and innumerable data. To this end, every roentgen therapist who can do so should keep accurate records of the physical characteristics of each dose of X-rays administered to his patients, and supplement them by notes on the effects produced on both healthy and diseased tissues.

NEW ENGLAND ROENTGEN RAY SOCIETY

NEW OFFICERS AND MEMBERS

At the annual meeting of the New England Roentgen Ray Society the following officers were elected for the ensuing year: President, Dr. Curtis H. Jennings, of Fitchburg, Mass.; Vice-president, Dr. Frank W. Lamb, of Portland, Maine; Secretary-Treasurer, Dr. Merrill C. Sosman, of Boston, Mass.; Member Executive Committee, Dr. A. S. Merrill, of Manchester, N. H.

Eight meetings were held during the year and thirteen new members were admitted, bringing the total to 116. Five men were proposed and elected as honorary members of the society in recognition of their early and important work in roentgenology. They are: Dr. Walter Cannon, Professor of Physiology, Harvard Medical School, Boston, Mass.; Dr. Ernest A. Codman, surgeon, of Boston, Mass.; Mr. Joseph Godsoe, former assistant of Dr. Walter Dodd, at the Massachusetts General Hospital of Boston; Professor Elihu Thomson, of the General Electric Company of Lynn, Mass.; Dr. Francis H. Williams, physician, of Boston, Mass.

NOTICE

PHILADELPHIA CLINICAL MEETING FOR ROENTGENOLOGISTS

Following a meeting last February, sponsored by the New York Roentgen Society, a committee consisting of Dr. David R. Bowen, Dr. Arthur C. Christie, Dr. George W. Holmes, Dr. Leopold Jaches and Dr. Charles A. Waters was formed to plan a meeting for 1928. This Committee has accepted an invitation unanimously tendered by the Philadelphia Roentgen Ray Society for the date (tentative) January 27-28, 1928.

The sessions, with the possible exception of Friday evening, will be wholly clinical. Most sessions will be given in the large amphitheatres accommodating the entire attendance, but it seems that a part will necessarily be given to smaller groups and upon the ticket plan. In any case, great pains

will be taken to so arrange and plan that no guest will "get lost" or needlessly waste time. Programs will be mailed January first to all members of local roentgen ray societies in the Atlantic States and to all who answer this notice.

The program will be as short as is consistent with the amount of material submitted. If any considerable number indicate a desire to spend the remainder of the week-end in Atlantic City, the program will end in time for them to take the 4 P. M. train on Saturday.

For programs, address Dr. David R. Bowen, Pennsylvania Hospital, Eighth and Spruce Streets, Philadelphia.

Requests or suggestions concerning items desired in the program should be sent to the Chairman of the Philadelphia Committee, Dr. Eugene Pendergrass, 3400 Spruce Street, Philadelphia.

RESOLUTIONS

The Radiological Society of North America, before the adjournment of its successful Thirteenth Annual Meeting, passed resolutions expressing the appreciation and gratitude of the Society to the committees and medical profession of New Orleans for the welcome extended and the many courtesies shown its members.

AMERICAN COLLEGE OF RADIOLOGY

A Convocation of the American College of Radiology was held during the week that the Radiological Society of North America met in New Orleans for its Thirteenth Annual Meeting. Honorary degrees of Fellowship in the College were conferred upon Prof. Franz M. Groedel, M.D., of Bad-Nauheim, Germany; A. Lacassagne, M.D., of Paris; Prof. Hermann Holthusen, M.D., of Hamburg; Prof. H. Behnken, Ph.D., of Berlin, and Jacques Forestier, M.D., of Aix-les-Bains, France, all of whom were present.

AWARDS IN THE SCIENTIFIC EXHIBIT

This year there was inaugurated the bestowal of awards in two groups—to individuals and to institutions. In the former group, the First Award to an Individual Exhibiting was made to Dr. Amédée Granger, of New Orleans; the Second Award to Dr. Webster W. Belden, of New York City, and the Third Award to Dr. Lloyd Bryan, of San Francisco.

In the latter group, the First Award to an Institution Exhibiting was made to the Cleveland Clinic; the Second Award to U. S. Marine Hospital No. 66, at Carville, Louisiana, and the Third Award to the Polyclinic, of Memphis, Tennessee.

THE COMMERCIAL EXHIBIT

The exhibitors at the Thirteenth Annual Meeting of the Radiological Society of North America occupied the spacious and richly decorated and carpeted hall on the ground floor of the Roosevelt Hotel, New Orleans. The radiologists in attendance passed continuously in and out, forming interested groups about the exhibits, and greeting friends among the exhibitors.

Geo. W. Brady & Co. had an attractive display of X-ray supplies and accessories. Mr. Brady was also displaying for the first time the new 5-inch 15-milliampere portable X-ray equipment, complete and containing all of the latest improvements.

This firm showed as well a small but exceptionally efficient instrument in Dr. Trostler's cardiometer, which, judging from the interest displayed, was approved by the majority of roentgenologists who had an op-

portunity to have its usefulness demonstrated.

Mr. Brady was joined by Mrs. Brady at the end of the meeting, as they had arranged to accompany the happy party on their visit to Havana and other ports. Their friends were agreeably surprised to note that Mr. Brady arrived some fifteen or twenty minutes prior to the departure of the boat, as they had previously made arrangements with the captain to let the gangplank drag along the dock, as they felt quite sure Mr. Brady would be arriving on *his* schedule.

An exhibit of marked interest to roentgenologists attending the meeting was that of the Picker X-ray Corporation, of New York City. Grouped around the booth in an attractive manner were machines and equipment of many types used in the practice of radiology and physiotherapy. Quartz lamps were shown as well as several new diathermy machines. The display also included a number of products bearing the "Picker-tested" seal. This seal is placed upon articles which have undergone a particularly searching examination by the Picker engineering staff and are recommended to the profession unreservedly.

Another feature of the Picker exhibit which attracted much attention and comment was a display of Kerasol, an unusual type of enteric coating used extensively in the oral method of cholecystography. This article, a product of the Picker laboratories, has recently undergone a number of changes in its process of manufacture—changes believed to be conducive to improvement over the original form in which it was presented. In speaking of Kerasol, Mr. James Picker, President of the company, who was in attendance at the exhibit, stated that, "While it is practically immune to the gastric secretions of the stomach, the improved type of Kerasol offers a very high degree of solubility in the intestines." This coating is transparent, non-porous, and hermetically seals the capsule it covers.

In addition to Mr. Picker, several other representatives of the Picker firm were present at the meeting.

The Liebel-Flarsheim Company, of Cincinnati, Ohio, exhibited the new Young-McKim-Smith Urological X-ray Table for urological and radiographic examinations, also urological operations. This new table embodies several added features which many operators have deemed advisable, such as the independently adjustable cystoscopic seat, movable back rest and new Koch knee crutches of the Goepel (European) type, with ball and socket mounting which permits of a wide range of adjustment. An L-F Flat Bucky Diaphragm of special design for genito-urinary work is built into the table as an integral part of it. The complete table top, knee crutches, Bucky diaphragm, and tube holder move as a complete unit so the relation between tube, patient and Bucky diaphragm is permanent and never varies.

In the new L-F Model C-530 Fluoroscopic-Radiographic Control and Energizing Unit, also on display, was seen the result of continuous development piece by piece over a period of five years. This includes many refinements in X-ray engineering, as the extra large Auto-transformer Control, Indicating (Inductive Type) Filament Control, Individual Meter Illumination, Oil Immersed Magnetic Switch, Automatic Exposure Switch and Electrically Welded All-metal Cabinet.

Other products exhibited were the L-F Treatment Timers for timing X-ray and physical therapy treatments, the L-F Dynelectron, Electric Scalpel and Model C-15 Fluoroscopic-Radiographic Control and Energizing Unit.

Few members failed to visit the extensive and diversified exhibit of the Victor X-ray Corporation. The radiographic display of their Educational Department was very interesting, especially those films devoted to soft tissue work. A newly developed Bucky table, built entirely of metal and so designed as to be available in several combinations covering the entire range of horizontal radiography and fluoroscopy, was given prominence in the section devoted to X-ray apparatus. The serial "fluorographic" unit and control, for making radiographs selectively during the fluoroscopic examination, seemed to attract even more interest than at its initial showing a year ago.

Although primarily an X-ray exhibit, some physical therapy apparatus was shown, also the new Victor portable electrocardiograph. The latter was one of the most attention-arresting instruments exhibited, drawing an interested audience at every demonstration. Only one who has operated one of the older type electrocardiographs can appreciate the simplicity and ease of operation, the compactness and flexibility of this new instrument. By a method similar to radio amplification, it "steps up" the feeble heart current to a point where it will actuate a sturdy galvanometer, thereby eliminating the fragile quartz string required in former types because of the infinitesimal actuating current. The Victor instrument can therefore be moved about freely without fear of damage. No longer need a hospital be wired for electrocardiographic service—this instrument, being entirely self-contained, is simply wheeled to the patient's bedside. It can also be carried to the patient's home when necessary. No special technical skill is needed to operate it; anyone can produce cardiograms of excellent diagnostic value after an hour's instruction. The consensus of opinion among those who witnessed its demonstration was that the Victor X-ray Corporation has made a notable contribution to the armamentarium of the cardiologist.

The Dumore Electric Mixer, which Horlick's Malted Milk Corporation showed in connection with its exhibit, attracted a good deal of interest among radiologists, because it affords a quick and convenient means of preparing the barium sulphate meal with Horlick's Malted Milk, either natural or chocolate flavor. "Horlick's" has become established in recent years as a suspension medium, partly because it produces a more palatable liquid than most mediums, and largely because it results in an even and stable suspension.

The chocolate product, put out by Horlick some years ago as "Malte-Chocla," and only recently introduced to the profession and the public as Horlick's Chocolate Malted Milk, is a blend of "the original" with sweet chocolate and cocoa. The ingredients, we are told, are processed by the exclusive Horlick vacuum method, which not only brings out their most delicious flavor in conjunction with the natural malted milk, but renders them highly digestible.

Another member of the Horlick family of products, hitherto unknown to the medical profession, is Horlick's Milk Modifier, a maltose and dextrin sugar, produced under the exacting Horlick standards of manufacture. The new modifier is purely a grain derivative, produced by the floor malting method, which develops natural malt enzymes and conserves the vitamin and mineral components of the grains. It is being detailed extensively by the Horlick force, and visitors to the meeting had an opportunity to learn more about it from attendants at the Horlick booth.

The new Engeln Motor-driven Tilt Fluoroscopic Table was one of the items of the new line of Engeln equipment which commanded attention and interest at the ex-

hibit of the Engeln Electric Company, of Cleveland, Ohio. It is claimed for this table that it represents many distinct improvements in its wide range of fluoroscopic vision, convenience in operation, and sturdy construction—motor-driven to any desired position from the Trendelenburg to the vertical, and furnished complete with counterbalanced flat Bucky-Potter diaphragm, if desired.

This firm's new line of transformers also embodies a number of interesting features. The kenotron rectifier, used with the 107,000 volt transformer, is immersed in the oil of the transformer tank, new and improved types of synchronous motors and double disc mechanical rectifiers eliminate almost entirely the usual phasing-in difficulties experienced with this type of equipment and reduce the noise to an absolute minimum. Simple, complete and attractive remote control units include all of the features which modern developments have made possible, such as a complete meter scale standardization and adjustment, a pre-reading filament indicator, and entirely new and improved type of switches throughout. Complete terminal boards carry all electrical connections to a convenient and easily accessible panel.

The new Engeln stabilizer, a complete line of tube stands, the vertical cassette changer, and the vertical fluoroscope were among the features of the exhibit which, for the benefit of those unable to study the apparatus personally, are completely described in the descriptive bulletins which are now ready for distribution.

The exhibit of the Medical Division of the Eastman Kodak Company, of Rochester, N. Y., consisted of a display of the possibilities of photography in the various branches of medical work, comprising the showing of films and accessories for roentgenology, clinical photographs made with simple equipment, and also medical motion pictures made with 16 millimeter amateur apparatus.

The Buck X-ograph Company, in a most comfortably furnished space at the head of the hall, showed the new Buck X-ray Film, which has been on the market a year, as well as Film Developing Hangers and Thermomonel Developing Tanks, the latter being a notable achievement in the way of retention of temperature. Mr. Buck also showed a complete line of cassettes in all sizes, with bakelite fronts, the latter so inserted in the frame that they are retained without the aid of screws.

The Patterson Screen Company, of Towanda, Pa., occupied a spacious booth, the exhibit being in charge of Mr. Carl V. S. Patterson, founder of the company and President of the corporation. They exhibited the well-known Patterson Cleanable Intensifying Screen and Patterson Fluoroscopic Screen. It may be of interest to those who have favorably known Patterson Screens for years, that these screens are being used by prominent roentgenologists in practically every corner of the globe. The Patterson Screen Company is one of the largest manufacturers of screens in the world and devotes much attention to research and development of Fluoroscopic and Intensifying Screens.

The X-ray and Physiotherapy apparatus exhibited by the Kelley-Koett Manufacturing Company, of Covington, Ky., represented this company's latest designs and its advances in the way of construction and operating conveniences.

The Synchronous Impulse Timer shown permits absolutely accurate time exposures varying from 1/120 second to 1/4 second. This timer is particularly applicable to fast chest and stomach radiography.

The Automatic Tube and Cassette

Changer is designed to facilitate the handling of patients for stereoscopic chest radiography. It consists of a pendulum cassette changer which operates coherently with an especially designed tube stand embodying an automatic stereoscopic tube shifting mechanism. These two pieces of equipment are so arranged that the tube is at all times centered on the cassette in the changer. The Synchronous Timer is usually used in connection with this equipment.

Advanced engineering in diathermy construction and operation predominates in the new Resogap Diathermy Unit. This unit is characterized by the "Resogap"—a mutually adjusted spark gap induction control. It is said to possess the necessary sensitiveness of control for the technics used in desiccation or in the treatment of small areas.

Other pieces of equipment shown were the Power Plus X-ray Generator, which, as usual with Keleket, has the transformer built oversize to amply provide for its guaranteed rating; a Diagnostic Table with its component parts so arranged as to have the entire front of the table free for the movement of the patient and for convenience of manipulation; a combination 8×10 and 14×17 Film Viewing Cabinet, and other X-ray and physiotherapy accessories.

The Wappler Electric Company, of Long Island City, N. Y., exhibited their complete line of Valve Tube X-ray Apparatus. Three types of equipment were shown—the Monex, for radiography, fluoroscopy, and superficial skin therapy; the Diex, for both diagnosis and therapy, and the Quadrocondex, which delivers continuous high voltage direct current for use in deep therapy.

In the operation of each, no mechanical rectifier is used, rectification of current being secured through the use of Wappler Kenex Valve Tubes. Among the advantages claimed to result from the valve tube method of rectification are: silence of operation, shorter times of exposure in radiography, shorter dosage times in therapy, freedom from maintenance troubles, due to the elimination of rotating parts, and continuity of operation despite unfavorable atmospheric conditions.

The Wappler Wheatstone Stereoscope was also shown. This stereoscope is of a new design, in which the indirect system of illumination is used, with separate controls for the intensity of illumination in each of the viewing boxes.

Among the Wappler personnel who attended were Dr. A. Mutscheller, physicist, and Mr. J. Zauner, of the New York Sales Department.

A newcomer among the exhibitors this year was Petrolagar. The use of this product as a mechanical treatment for intestinal stasis is familiar to all, but its application in roentgenology, though fairly recent, is exciting a great deal of interest.

At their display gastro-intestinal plates made with Petrolagar as a medium for the barium were shown. Many favorable remarks were heard on the sharpness of these films. Jars were exhibited showing typical meals made up with the opaque material in perfect suspension.

Another feature of the display consisted of life-sized drawings of the intestine by Tom Jones, Associate Professor of Anatomy at the University of Illinois, smaller copies of which were distributed gratis.

A surprising point in the use of Petrolagar as a barium meal is its low cost, due to the very small quantity required for a meal. Other advantages are completely set forth in the Laboratories' detailed literature on the subject, presented to interested visitors. The initial display undoubtedly re-

ceived its full share of study by the attending physicians.

J. A. Majors Co., Southern booksellers, with stores at New Orleans and Dallas, had a comprehensive exhibit of medical books, including all the latest and leading volumes on X-rays, Radium, Medical Electricity, Physiotherapy, Diathermy, etc. Some of the works that attracted much attention were: Braasch, Urography; MacKee, X-rays and Radium in the Treatment of Skin Diseases; Holmes and Ruggles, Roentgen Interpretation; Redding, X-ray Diagnosis; Bertwistle and Shenton, Atlas of Visceral Radiograms; Annals of Roentgenology (various volumes); Hirsch, Roentgen Therapy; McKendrick and Whitaker, Atlas of Normal and Abnormal Structures of the Body; Wessler and Jacques, Clinical Roentgenology of Diseases of the Chest, and Radiophysiologie et Radiotherapie, published by Les Presses Universitaires de France.

In addition to having two stores in the South where all publishers' books are handled, the Majors Company are also Southern agents for the W. B. Saunders Co., of Philadelphia. Majors is one of the few houses in this country that limit themselves to the sale of medical books and medical periodicals.

The Hanovia Chemical and Manufacturing Company, of Newark, N. J., had a display of Kromayer lamps of all types, together with Alpine Sun Lamps of the floor stand and ceiling suspension types.

The Radiograph-scope Company, of Greensboro, N. C., showed the Radiographic Angle Head Table, with adjustments which achieve the following points: (1) A universal adjustment of cassette holder for making radiographs at any angle or angles in the sitting positions (lying positions by using the angle head table with any other table); (2) The table may be brought to the desired height for the most comfortable position of each individual patient's size and posture; (3) Head supports to maintain the position of the head during exposure; (4) Arm support to fix shoulders of patient when in the sitting position; (5) Lock to give table the solidity of one piece (even the vibration of breathing can be eliminated); (6) Dials show cassette angles to be registered with the technician's technic and other data.

Dr. Reaves also demonstrated the usefulness of the Calibrated Marker and Cover. This marker is used to register positions and angles of target, patient, and cassette. It enables the technician to "blue-print shadowgraph technic," a most essential point in securing duplicates, records, or retakes.

For those interested in the study of optics was shown the Calibrated Shadowgraph-scope, designed to duplicate stereoshadowgraphs, positions, and angles to the optical center of the mirror box that cassettes were to target at exposure. When the shadowgraphs are reflected to the observer's eyes by co-ordination of illuminating boxes, mirror box and the observer's eyes, the shadows are projected by his optical complex which builds in relief from shadows a transparent image of the opaque body, giving true topography, detail, and third dimension.

The French Screen Company, of Detroit, Mich., was represented, as this company always is, at the Society's commercial exhibits.

The Standard X-ray Company exhibited a new Flat Top Combination Radiographic and Fluoroscopic Bucky Table, of all-metal construction. A new Double Disc Seven-inch X-ray Machine, incorporating the

"Patented Safety Winding," was also shown.

Considerable interest was shown by members of the Society in the Standard Roentgenometer, a direct reading measuring instrument for the determination of X-ray dosage.

Three sizes of Single Illuminators also attracted much interest.

The Acme-International X-ray Company, of Chicago, Illinois, showed their latest models of Precision Coronaless apparatus, including the new 150 K.V. Super-high-speed Generator, with 100 point autotransformer control. This machine created a great deal of interest because of its unique construction, its great power—500 milliamperes at 87 kilovolts—its ability to maintain a stability of milliamperage over a long range of kilovolt variations, and superspeed characteristics of the transformer.

The famous "Six-sixty" built by the company was on exhibition in its new form and new name—"Six-sixty Plus." This machine has been improved and its output greatly increased. A "Six-sixty" mobile unit for hospital bedside work was an attractive feature. The new model for diathermy made its initial bow to Southern medical circles.

Mr. Montford Morrison, chief engineer of the Acme-International X-ray Company, was in attendance, greeting his friends and receiving their congratulations on his new products.

The newly organized Educational Department had a beautiful exhibit of films which attracted much interest and discussion, Mr. Herbert Newman, of the Educational Department, being kept busy explaining fine points in X-ray technic.

Mr. J. Victor Feather represented the Acme-International X-ray Company, and was assisted by Mr. C. G. Buchanan, of the New Orleans branch, and Mr. M. B. Evans, who represents Acme-International in Detroit.

BOOK REVIEW

ULTRA-VIOLET RADIATION AND ACTINOTHERAPY. By E. H. RUSSELL, M.D., and W. K. RUSSELL, M.D. Second Edition. Published by William Wood & Company. Price $5.00.

This second edition is a very excellent work on ultra-violet therapy. There is much of interest to every physician in this well-written textbook. The chemical and physical properties of ultra-violet rays and their biological effects are very thoroughly discussed and the special features of a great many lamps, both carbon tungsten and iron arc lamps, as well as the mercury vapor, are all explained in detail, with many photographs of apparatus. In the eighty pages devoted to technic are many valuable suggestions concerning the actual use of ultra-violet radiation. The matter of dosage is clearly explained. One-third of the book is devoted to the discussion of the treatment of skin diseases, tuberculosis, disorders of nutrition, alimentary and respiratory diseases, and miscellaneous diseases. There are numerous case reports. In general, over-enthusiasm has been avoided. Numerous illustrations enhance the value of the book.

ABSTRACTS OF CURRENT LITERATURE

INDEX TO ABSTRACTS IN THIS ISSUE

ALBEE, FRED H. Spondylolisthesis....81, 82
BACHEM, A., and MACFATE, R. P. On the Question of Cholesterin Change after X-ray Irradiation *in Vitro*.... 91
BAUMANN, M. Development of Sarcoma Following Roentgenotherapy of Joint Tuberculosis 92
BEHNKEN, HERMANN. The Absolute Measurement of the Dose Unit "One Roentgen" in the German Bureau of Standards.... 82
CHANDLER, L. R., and NEWELL, R. R. Cholecystography and Pathologic Changes in the Gall Bladder....87, 88
CONE, SYDNEY M. Bone in Hodgkin's Disease.... 88
CRANE, A. W. A Roentgenologic Sign of Mucous Colitis....88, 89
CUSHING, HARVEY. The Intracranial Tumors of Pre-adolescence 91
DAUTWITZ, FRITZ. Lymphogranulomatosis and Radium Therapy 86
DAVIDSON, S. C. Traumatic Pneumoventricle of the Cerebrum: Report of Two Cases....84, 85
DILLON, JAMES R. Ureteral Reflux.... 89
FINKENRATH, K. Effect of a Combination of Radiation on the Skin.... 86
FLINN, FREDERICK B. A Case of Antral Sinusitis Complicated by Radium Poisoning.... 87
FRIEDRICH, W. Physical Principles of Radium Therapy 80
GAERTNER, O., and KLOEVEKORN, G. H. Roentgen Rays and Unicellular Organisms (III)... 81
GLOCKER, R. The Fundamental Law of the Physical Effect of Roentgen Rays of Various Wave Lengths and its Relation to the Biological Effect 80, 81
GOLDSTEIN, L. The Roentgen-ray Treatment of Tuberculosis of the Larynx....90, 91
GOLLWITZER, H. (*with* HOLTHUSEN, H.).... 88
GRUSCHETZKAJA, M. Regarding the Roentgenotherapy of Papilloma of the Larynx.... 91
HIRSCH, H. The Mekapion Dosimeter in Roentgen Laboratories.... 80
HOLTHUSEN, H., and GOLLWITZER, H. The Measuring of the Quality of Roentgen Rays in Deep Therapy.... 88
IVANCEVIE, I. (*with* PAULI, W. E.).... 84
KELLY, THOMAS C. (*with* STURTEVANT, CHARLES N.).... 92
KLOEVEKORN, G. H. (*with* GAERTNER, O.).... 81
KOCH, LUDWIG. Regarding the Behavior of Chloride in the Erythrocytes in Roentgen-ray Treatment.... 86
KRYNSKI, A. (*with* NEUMARK, S.).... 91
KUESTNER, HANS. How Many Roentgen Units Correspond to the Erythema Dose?.... 47
LAZAREW, N. W., and LAZAREWA, A. Regarding the Change of the Functional Stage of the Blood Vessels after X-ray Exposure. Third Communication: On the Question of the So-called Latency of the X-ray Effect.... 90
LAZAREWA, A. (*with* LAZAREW, N. W.).... 90
LEWIN, PHILIP. Osteochondritis Deformans Juvenilis of the Shoulder Joint.... 84
LINTZ, WILLIAM. Cholecystography and Lyon-Meltzer Test in a Patient with a Congenitally Absent Gall Bladder.... 80
MACFATE, R. P. (*with* BACHEM, A.).... 91
MARXER, O. A. (*with* SPRIGGS, EDMUND I.)....83, 84
MEYERS, H. L. (*with* SIMS, G. K.).... 83
MORRISSEY, EDMUND J. (*with* WOLFSOHN, JULIAN M.)....89, 90
MUZII, MARIO. Radiological Diagnosis of Ascariasis 83
NEUMARK, S., and KRYNSKI, A. Regarding the Treatment of Lichen Ruber Planus by Roentgen-ray Exposure of the Spinal Cord and Sympathetic Ganglia.... 91
NEWELL, R. R. (*with* CHANDLER, L. R.)....87, 88
PAULI, W. E., and IVANCEVIE, I. Investigations of the Absorption Property of the Skin in the Long Wave Range of the Spectrum.... 84
PAULI, W. E. On the Artificially Increased Transparency of Animal and Human Skin for the Long Wave Part of the Spectrum.... 84
RAHM, H. Late Necrosis of the Mandible Following Roentgenotherapy....91, 92
RAJEWSKY, B. Contribution to the Problem of Back Scattering.... 80
RANKIN, J. O. A New Fracture Table to be Used in Conjunction with the Fluoroscope.... 92
REKLING, E. (*with* SONNE, C.).... 85
REKLING, E. Investigations of the Mechanism of the Effect of Light on Experimental Rickets in Rats.... 85
SHELDON, W. P. H. Congenital Atresia of the Alimentary Tract.... 92
SHERMAN, JULIUS. Primary Carcinoma of the Lung 86, 87
SIMS, G. K., and MEYERS, H. L. Report of a Case of Congenital Malformation and Arrested Development of the Colon.... 83
SONNE, C., and REKLING, E. The Treatment of Experimental Rickets in Rats with Monochromatic Ultra-violet Light.... 85
SONNE, C. To Which Part of the Ultra-violet Spectrum is the Biological Effect Due?.... 85
SPIELBERG, WILLIAM. Visualization of the Eustachian Tube by the Roentgen Ray: Preliminary Report.... 90
SPIERS, H. W. Congenital Luxation of the Knee 81
SPRIGGS, EDMUND I., and MARXER, O. A. Multiple Diverticula of the Colon....83, 84
STEIN, SIMON. Fracture of the Outer Table of the Frontal Sinus.... 89
STOKLASA, JULIUS. The Influence of Radioactivity on the Sugar Metabolism in the Living Cell.... 87
STRAUSS, S. The Dosimeter "Mekapion" and its Exactness in Measuring.... 80
STURTEVANT, CHARLES N., and KELLY, THOMAS C. Neurocytoma of the Left Suprarenal Gland with Metastasis to the Liver, Skull, and Bones 92
WATERS, CHARLES A. (*with* YOUNG, HUGH H.) 82, 83
WHITAKER, LESTER R. The Mechanism of the Gall Bladder and its Relation to Cholelithiasis 85, 86
WOLFSOHN, JULIAN M., and MORRISSEY, EDMUND J. On the Value of Lipiodol as an Aid in Neurologic Localization: A Report Based on Six Cases....89, 90
YOUNG, HUGH H., and WATERS, CHARLES A. Deep Roentgen-ray and Radium Therapy in Malignant Disease of the Genito-urinary Tract 82, 83

Physics of radium therapy.—Friedrich gives in this paper a brief summary of some of the physical principles of radium therapy. He also relates the results of the investigations carried out by himself and his co-workers which led, for instance, to the measuring of the distribution of radium energy in the body. His isodoses are well known and very valuable in practical therapy. The difference between roentgen rays and radium as far as it concerns treatment work is also explained. The article is recommended for study in the original.

E. A. POHLE, M.D.

Physical Principles of Radium Therapy. W. Friedrich. Strahlentherapie, 1927, XXVI, 4.

Back scattering in roentgenotherapy.—The author describes a photographic method for measurement of the amount of back scattering in roentgenotherapy. A film is exposed in three places, on one directly, on another lying above a block of four layers of material, paper, aluminum, copper, and lead, and the third field placed under a block of the same composition. The blackening in the first spot corresponds to the total intensity, the second to the primary intensity without back scattering, and the third to the back scattering only. The author's results check within reasonable limits with the ionization method.

E. A. POHLE, M.D.

Contribution to the Problem of Back Scattering. B. Rajewsky. Strahlentherapie, 1927, XXVI, 158.

Congenitally absent gall bladder.—The examination of a patient who proved to have a congenitally absent gall bladder, by intravenous administration of 5.5 grams of tetrabromphthalein, caused a severe reaction and, as would be natural, no shadow of gall bladder. It was interesting that the Lyon-Meltzer test gave the typical three-colored specimen, which would indicate that the B specimen certainly does not always come from the gall bladder, if it ever does.

This is said to be the first reported case of congenitally absent gall bladder in which cholecystography and the Lyon-Meltzer test were performed.

W. W. WATKINS, M.D.

Cholecystography and Lyon-Meltzer Test in a Patient with a Congenitally Absent Gall Bladder. William Lintz. Am. Jour. Med. Sci., May, 1927, p. 682.

The "Mekapion."—This new dosimeter which has been described before (see this Journal, 1927, VIII, 436) has been supplemented by a recording device which writes the dose on a strip chart.

E. A. POHLE, M.D.

The Dosimeter "Mekapion" and its Exactness in Measuring. S. Strauss. Strahlentherapie, 1927, XXVI, 200.

The "Mekapion" in practice.—Hirsch recommends the Mekapion as the best and most reliable dosimeter available at present.

E. A. POHLE, M.D.

The Mekapion Dosimeter in Roentgen Laboratories. H. Hirsch. Strahlentherapie, 1927, XXVI, 207.

Wave length of roentgen rays and biophysical effect.—One of the most important problems in roentgen therapy is the effect of roentgen rays of different wave lengths but equal intensity as recorded by our measuring instruments. The author has carried out numerous measurements in connection with this question and concludes that all physical effects of roentgen rays follow the same law; only that part of the X-ray energy will be effective which is transformed into electron energy. He differentiates two classes of physical effects, one where photo- and Compton electrons are

present, and the other where photo-electrons only must be considered. The comparison of the changes of the ionization, the blackening of the photographic paper, the fluorescence of the screen, and the resistance of a selenium cell by roentgen rays of different wave lengths but equal intensity shows a fair agreement of experimental and calculated values. The ratio of two quantities of roentgen rays of different quality but the same biological effect varies with the method of measurement. It is entirely different, for instance, when recorded by ionization than by the photographic method. As to the erythema dose for the human skin, which, according to Meyer and Glasser, Wintz, and Rump, requires a smaller number of roentgen units for a long wave length than for a short, Glocker finds that his own experiments are in agreement with their results. Slow electrons seem to have very little, if any, biological effect.

E. A. POHLE, M.D.

The Fundamental Law of the Physical Effect of Roentgen Rays of Various Wave Lengths and its Relation to the Biological Effect. R. Glocker. Strahlentherapie, 1927, XXVI, 147.

The mechanics of luxation of knee.—Four cases of luxation of the knee are reported. All were congenital. The condition is uncommon although it can hardly be classed as a rarity. The ultimate causal factors are unknown. The mechanics of luxation would seem to be that in the gradual development of the hyperextended position, the comparatively strong quadriceps and fascia lata have the mechanical advantage over the inner and posterior muscle groups. The author's cases were treated successfully by traction and retention devices. The article is well illustrated by roentgenograms showing the condition.

LE ROY SANTE, M.D.

Congenital Luxation of the Knee. H. W. Spiers. Jour. Bone and Joint Surg., July, 1927, p. 469.

Biological effect of roentgen rays.—The authors have started a study of the effects of rays of various wave lengths on unicellular organisms. They present in this article the results of experiments dealing with the action of infra-red and red rays, *i.e.*, heat. Cultures twenty-four hours old were placed in the water bath at 60 degrees Centigrade. It appeared that—

Bact. coli	died after 6 min.
Staph. pyog. aureus	died after 11.5 min.
Bac. mesentericus	no influence.
Bact. coli	died after 5.5–6 min.
Staph. pyog. aureus	died after 10.5 min.
Bac. mesentericus	no influence.
Bact. coli	died after 5.5 min.
Staph. pyog. aureus	died after 10 min.
Bac. mesentericus	no influence.

E. A. POHLE, M.D.

Roentgen Rays and Unicellular Organisms (III). O. Gaertner and G. H. Kloevekorn. Strahlentherapie, 1927, XXVI, 211.

Forward displacement of spinal column.—Spondylolisthesis, once thought to be very rare, has in recent years been encountered more often owing to the use of the X-ray. It is a displacement of the whole spinal column forward in relation either to the fifth lumbar vertebra and sacrum and pelvis or the sacrum and pelvis. There is forward subluxation of the body of the fourth or fifth lumbar vertebra on the vertebra below it, or on the sacrum. The fifth is most frequently displaced, the fourth less so, and the sacrum rarely. The essential point is not so much the subluxation of the body of the vertebra as the anteroposterior elongation of its body. This exists always and is apparently the pathological condition peculiar to this situation and this condition. Each vertebra develops from three centers, one for the body and one for each lamina and its processes. That deficient union or absence of union between the vertebral laminæ and the bodies is not extremely rare is shown by Langer, who estimated that the defect oc-

curs in 10 per cent of all skeletons. A committee of the London Obstetrical Society reported that this condition was probably due in a majority of cases to "a solution of continuity across the neural arch of the fifth lumbar vertebra between its superior and inferior processes on either side."

Numerous illustrations indicating the X-ray appearance of the lesion accompany the article. Up to the present any treatment proposed has been palliative. The author has successfully treated eight such cases by bone graft transplants applied to the spine. Each individual case requires a different type of graft.

LE ROY SANTE, M.D.

Spondylolisthesis. Fred H. Albee. Jour. Bone and Joint Surg., July, 1927, p. 427.

The German roentgen unit.—In order to facilitate a control of the roentgen unit as defined by the German Bureau of Standards, Behnken gives in this paper a detailed account of his apparatus and method. It is hoped that all who are working on the problem of dosimetry in roentgen units will read this article in the original.

E. A. POHLE, M.D.

The Absolute Measurement of the Dose Unit "One Roentgen" in the German Bureau of Standards. Hermann Behnken. Strahlentherapie, 1927, XXVI, 79.

Genito-urinary tract.—In the first part of this excellent article deep roentgen-ray therapy is considered. The methods of arriving at correct dosage are first discussed, together with the technic of application. There is also some consideration of the various complications which may arise in the course of this treatment.

In renal neoplasm it is the custom of Young and Waters, after a radical operation, to deliver 130 per cent of an erythema dose through this area and through the lower mediastinum, as metastases occur in the chest more frequently than in other places. Beneficial results were also obtained in treating the tumor of the kidney directly.

They report 130 cases of bladder tumors in this series. By a combination of fulguration, radium, and cautery excision about 75 per cent of these tumors can be destroyed. About 25 per cent of hopeless tumors cannot be treated in this manner, but, by combination of radium and roentgen-ray treatment, many of these tumors can be destroyed, with a minimal amount of damage to the bladder. They believe, however, that operable tumors should have radical resection. In those cases which are incurable, regardless of the therapy employed, deep roentgen-ray therapy is an excellent palliative measure.

In cases of benign prostatic hypertrophy where the condition is attended by considerable risk from the operative treatment, a few cases can be relieved, but as a rule it is not of great value.

Their procedure in carcinoma of the prostate is to do á radical operation in favorable cases, followed by application of radium through the operative wound. In certain cases radium is also applied through the rectum and through the urethra and through the bladder. Conservative perineal prostatectomy is also used to relieve obstruction, pain, or hemorrhage. In all types of cases deep roentgen-ray therapy has been employed. In two cases of sarcoma of the prostate the tumor has disappeared following application of radium and deep roentgen-ray therapy.

They report 12 cases of tumor of the testicle. Six of these patients showed evidence of metastases and all are dead. The remaining six patients, in whom no metastases could be demonstrated, are living and free of metastases. Deep roentgen-ray therapy was administered over the abdominal and thoracic aortic glands and was repeated in three months. Nine cases of carcinoma of the penis are reported. All were treated with radium locally and deep roentgen therapy over the regional lymph glands. All of these patients are dead.

In the latter half of the article the subject of radium therapy is discussed. This has

found a limited use in tumors of the kidney and ureter, with not entirely satisfactory results.

Under carcinoma of the bladder a description is given of the authors' cystoscopic radium applicator and of the various means of applying radium to the lesions.

In cases of carcinoma of the prostate radium is applied through the rectum, also through the urethra and by implanting with radium needles. This is usually followed by deep roentgen-ray therapy. Surprising alleviation of symptoms can often be obtained. In carcinoma of the urethra and testicles this treatment has been rather disappointing.

HOWARD P. DOUB, M.D.

Deep Roentgen-ray and Radium Therapy in Malignant Disease of the Genito-urinary Tract. Hugh H. Young and Charles A. Waters. Am. Jour. Surg., February, 1927, p. 101.

Roentgen examination for ascariasis.—The author publishes details of three cases of ascariasis, with radiograms showing the presence of the parasites. The medium used was a mixture of milk and water containing 150 grams of gelatinous barium sulphate. The worms appear as transparent streaks, and by pressing on the intestine to squeeze out the barium they can be shown more clearly. In some cases the worms swallowed some of the barium mixture and became opaque owing to the barium in their intestinal canal.

Radiological Diagnosis of Ascariasis (Diagnosi radiologica dell'ascaridiosi). Mario Muzii. Il Policlinico, Sez. Prat., January 17, 1927, p. 83. (Reprinted by permission from Brit. Med. Jour., March 19, 1927, p. 55 of Epitome of Current Medical Literature.)

Malformation of colon.—The author found only eleven similar cases in the literature. The colon was a cord-like structure, without a mesentery, that extended from the ileocecal junction diagonally upward from just below the navel to the left costal margin and down to the crest of the ilium. Here it widened into the colon again. The appendix was attached to the distal end of the ileum. Microscopic section of the cord-like structure did not reveal any lumen for four centimeters and then a gradually increasing opening.

C. G. SUTHERLAND, M.B. (TOR.)

Report of a Case of Congenital Malformation and Arrested Development of the Colon. G. K. Sims and H. L. Meyers. Am. Jour. Obst. and Gynec., December, 1926, p. 887.

Diverticula.—The authors have observed and treated 208 cases of multiple diverticula of the colon. Four stages in the development of diverticula are recognized: (1) Prediverticular stage, in which a ragged outline of small convex irregularities replaces the normal segmentation. This stage is associated with weakening of the submucosa and muscular layers, but precedes the stage of pouch-formation. (2) Stage of irritation. (3) The developed diverticula. (4) Diverticulitis. Inflammatory changes arise about necks of pouches, especially those containing stercoroliths, and spread to wall of colon, causing a local colitis.

The authors do not find that diverticulitis occurs without some evidence of diverticula.

Both the barium enema and meal are used by the authors but they find that, in two hundred cases in which both were used, in only two cases did the enema fail to show diverticula.

The common symptoms noted in their series of cases consisted of—(*a*) Abdominal discomfort, less often pain and not related to food, about or below the navel, especially on the left side. If pain is present, it may be severe, with backache and dragging sensation. (*b*) General flatulence and feeling of distention may be the only complaints. (*c*) Constipation, irregularity of bowels, diarrhea are present at various intervals. (*d*) Pain during or after evacuation. Hemorrhage as a symptom is unusual.

The pathology is that of chronic inflamma-

tion in the pelvic colon, arising at first from one or more diverticula and involving eventually all coats of the gut, including the peritoneum. It may also spread to surrounding parts, especially to the bladder in men. It may also extend to the small intestine, or abdominal wall, and to the uterus and ovary in women. In the later stages, abscess may form in the inflamed area. The authors give medical and surgical treatment indicated in the various stages. They believe that if a case is recognized, adequately treated and watched with a barium enema every six months if diverticulitis is diagnosed (every year if diverticulous), the severer complications may be avoided and radical surgery may not prove necessary.

H. J. Ullmann, M.D.

Multiple Diverticula of the Colon. Edmund I. Spriggs and O. A. Marxer. Lancet, May 21, 1927, CCXII, No. 5412, p. 1067.

Absorption of light in the skin.—The therapeutic effect of light will be better understood when we know how various parts of the spectrum are absorbed in the skin. The authors offer in this article the results of their investigations dealing with the measurements of the transparency of the skin of human beings and rabbits for wave lengths from 5,800 to 12,000 Ångstroms. A carbon arc, spectral apparatus, and thermopile were used in the experiments. The details of their technic are given exactly, in order to facilitate a repetition and control of their findings. It appeared that the human skin is very transparent for longer light waves. The maximum of 47.6 per cent was transmitted between 7,000 and 7,600 Ångstroms. The skin of rabbits showed similar properties; in the infra-red the transparency was still higher (68 per cent). All these figures hold true for skin outside of the body. Comparative measurements on the ears of rabbits inside and outside of the body demonstrated the fact that the skin within the body absorbs 4 per cent more.

In the second paper, Pauli relates an account of his attempt to increase the transparency of the skin for light waves. Injection of dyes, for instance, eosin, dissolved in physiological sodium chlorid solution, led to negative results; after application of olive oil, there was an increase in the transparency of over 16 per cent in the infra-red region. Glycerin gave a still higher value.

E. A. Pohle, M.D.

Investigations of the Absorption Property of the Skin in the Long Wave Range of the Spectrum. W. E. Pauli and I. Ivancevic. Strahlentherapie, 1927, XXV, 532.

On the Artificially Increased Transparency of Animal and Human Skin for the Long Wave Part of the Spectrum. W. E. Pauli. Strahlentherapie, 1927, XXV, 546.

Shoulder joint.—As far as the author has been able to ascertain, the case which he reports is the only one reported in the literature where this disease has been found in the shoulder joint. At birth, this child showed a typical birth paralysis involving the right arm. Roentgenograms revealed no definite bone or joint lesion. A good functional result was obtained after several years' treatment. X-rays taken four years later revealed the following condition: "The head of the right humerus is articulating with the glenoid cavity. The noteworthy points are the flattening of the medial and inferior surfaces of the head of the humerus, with fragmentation and changes in the glenoid cavity. There is a well developed cervical rib on the right side and the right scapula is elevated." The report is illustrated by radiographs showing the condition.

Le Roy Sante, M.D.

Osteochondritis Deformans Juvenilis of the Shoulder Joint. Philip Lewin. Jour. Bone and Joint Surg., July, 1927, p. 456.

Air in ventricles.—The term "pneumoventricle" is used to denote the presence of air within the ventricles. The condition follows

injury and is associated with fracture of the skull. Synonymous terms are "pneumocranium," "pneumocephalus," "intracranial aerocele," and "traumatic aerocele." Dandy uses the term "pneumocephalus," subdividing the condition into four varieties, arachnoid, subdural, intracerebral and interventricular. Dandy reviewed the subject (*Archives of Surgery*, 1926, XII, 949), compiling from the literature 25 cases in all. The author reports two cases, with a mortality rate of 50 per cent.

C. G. SUTHERLAND, M.B. (TOR.)

Traumatic Pneumoventricle of the Cerebrum: Report of Two Cases. S. C. Davidson. Am. Jour. Roentgenol. and Rad. Ther., April, 1927, p. 447.

Biological studies of ultra-violet light.—The Finsen Institute (Copenhagen) contributes here three very interesting papers, the first of which deals with the treatment of experimental rickets in rats, with monochromatic ultra-violet light. Using a very powerful spectrograph, which permitted the operator to single out ultra-violet rays of from 2,000 to 3,660 Ångstroms of sufficient intensity, the long debated question of what wave length contributes the rickets healing agent was investigated. In conclusion, the authors state that the lines 3,020 to 2,970, 2,800 to 2,650 to 2,530 did heal; 2,480 and 2,400 had some influence; 3,130 was of questionable effect and 3,660 did not affect rickets at all. Beyond line 2,970, no influence could be observed, which was probably due to lack of energy in that region. The healing property of ultra-violet light reaches beyond the shortest ultra-violet in the sun.

Sonne also studied the biological effect of the ultra-violet spectrum; first, the erythema and pigmentation of the human skin. He confirms the results of Hausser and Vahle, who found the maximum erythema line at 2,970. The hemolysis of the red blood corpuscles and the fatal effect of paramecium are due to different lines in the spectrum. While the maximum of hemolysis was found at 2,800, the killing curve presents a steep slope from 2,500 up to a maximum of 2,400 Ångstroms. Erythema, hemolysis, and killing effect curves all begin with a minimum at about 3,150 Ångstroms. These experiments do not furnish any support of the assumption that the therapeutic effect of ultra-violet rays is due to the same spectral region which produces the erythema in the skin.

In the third article, Rekling gives an explanation for the observations of Nelson and Steenbock, who reported that rickets in rats was healed by merely placing these animals in the same cage with other rats that had been irradiated with ultra-violet light. In special cages, his animals were prevented from reaching their bodies with their tongues. The rickets did not heal in spite of ultra-violet treatment. It is concluded, therefore, that the fatty secretion of the skin is activated by the ultra-violet rays and the so activated substances are taken in *per os*.

E. A. POHLE, M.D.

The Treatment of Experimental Rickets in Rats with Monochromatic Ultra-violet Light. C. Sonne and E. Rekling. Strahlentherapie, 1927, XXV, 552.

To Which Part of the Ultra-violet Spectrum is the Biological Effect Due? C. Sonne. Strahlentherapie, 1927, XXV, 559.

Investigations of the Mechanism of the Effect of Light on Experimental Rickets in Rats. E. Rekling. Strahlentherapie, 1927, XXV, 568.

The gall bladder.—The fundamental condition to gallstone formation is universally recognized to be stasis. One of the factors in the prevention of gallstones should be the effort to combat stasis by a proper dietetic habit. This should include taking meals, at long intervals, which are fairly rich in fat. A person should be really hungry at the time of eating; the digestive organs will then attack vigorously and the gall bladder will empty itself in a few hours. The meal is disposed of rapidly, the gall bladder refills rapidly with bile, the organ is subjected to two or three good flushings daily, allowing

little chance for precipitation or long continued irritation by foreign particles. It is quite apparent that small stones and débris can be cleaned out of the gall bladder by this process. If the gall bladder contains masses too large for easy passage through the cystic duct, the giving of food rich in fat may only aggravate the symptoms. If the gall bladder is so affected as to prevent the activity of its musculature, emptying will not occur.

C. G. SUTHERLAND, M.B. (TOR.)

The Mechanism of the Gall Bladder and its Relation to Cholelithiasis. Lester R. Whitaker. Jour. Am. Med. Assn., May 14, 1927, p. 1542.

Combined effect of radium and light rays on the skin.—The author relates the history of a girl twelve years of age who received radium treatment over keloids which followed treatment for lupus. After the fifth radium application, general exposure with carbon arc light was started; the eighth application of radium was given simultaneously with the light. Two weeks later a very severe erythema, with central ulceration, appeared at the site of the combined radium and light application. It is assumed that the hyperemia due to the carbon arc exposure enhanced the effect of the radium treatment.

E. A. POHLE, M.D.

Effect of a Combination of Radiation on the Skin. K. Finkenrath. Strahlentherapie, 1927, XXV, 591.

Radium in Hodgkin's disease.—The author relates in this paper his experience with radium in the treatment of Hodgkin's disease, based on 56 cases (27 males, 29 females) observed during the period 1913-25. Twenty-two patients had had X-ray therapy before, seventeen cases recurred after surgical removal, four had both surgery and radiation, and only seventeen were primarily treated with radium. The applicators used contained from 16 to 99 milligrams radium element distributed over a surface of 28 by 26 cm., or were enclosed in glass tubes of from 2 to 4 cm. length. The exposure was given through 1.5 lead, at 2 to 4 cm. distance over the lesions for six to ten hours. One of the series lasted one to four weeks, with intervals of from fourteen to thirty-six hours, amounting to a total dose of 16,000 to 30,000 mgh. Between the exposures there were rest periods of from one to twenty-five months. The results were satisfactory so far as relief and prolongation of life were concerned. Although one cannot speak of an absolute cure in this type of case, the author feels that even in an advanced stage of the disease, palliation alone is an indication for treatment.

E. A. POHLE, M.D.

Lymphogranulomatosis and Radium Therapy. Fritz Dautwitz. Strahlentherapie, 1927, XXV, 375.

Chloride content of erythrocytes after irradiation.—Following roentgen-ray treatment, the chloride content of the serum is usually diminished. We do not know, however, where this chloride is shifted. Investigations of the problem show that out of twenty cases, thirteen had a higher percentage of water and more or slightly less chloride in the red blood corpuscles than before irradiation. An inversed effect was observed in seven patients who had a high vagotonus; they also responded with a very marked X-ray sickness. Glucose is recommended as prophylactic in this type of case.

E. A. POHLE, M.D.

Regarding the Behavior of Chloride in the Erythrocytes in Roentgen-ray Treatment. Ludwig Koch. Strahlentherapie, 1927, XXV, 470.

Pulmonary cancer.—Primary carcinoma of the lung, formerly considered a rare disease, has of late years shown a markedly increased prevalence. Early diagnosis is difficult owing to the insidious character of the symptoms and their tendency to simulate

those of other diseases, such as tuberculosis, cardiorenal diseases or other inflammatory processes of the lungs. It is difficult to make an early diagnosis even with the roentgen ray because of the variability of the location of the tumor and its secondary complications, such as pleural effusion or inflammatory reactions in the lung tissues. Early diagnosis is the most important factor in the treatment. Surgery offers the best means for a possible cure or for prolonging the life of the patient. The success of surgical treatment depends on the location and the type of malignancy. The roentgen ray and radium have not proved at all successful.

F. B. Sheldon, M.D.

Primary Carcinoma of the Lung. Julius Sherman. Calif. and Western Med., January, 1927, p. 40.

Antral sinusitis complicated by radium poisoning.—Dr. Flinn, in reviewing the matter of so-called radium poisoning among girls working with luminous paint, finds that a certain amount of radium is deposited within the body. He has found as much as 100 micrograms of radio-active material present. This is eliminated very slowly—only about 1 per cent a month. He finds that by the administration of ammonium chlorid, 5 grams each day, he is able to increase the elimination a great deal. He does not think that the amount of radium within the body is directly responsible for the deaths that have occurred, but that its presence lowers the resistance to other infections.

The radio-active substance found was not confined to the point of ingestion, but was found in all portions of the body. Complete blood counts and hemoglobin did not prove to be an index to the amount of radio-active substance ingested or the amount of exposure received by the patient. These tests he found to be quite normal until some infection intervened, at which time there was a rapid drop in the number of red blood cells and hemoglobin. He describes fully one case in which he found 100 micrograms. The patient is still living and still retains 10 micrograms two years after beginning of treatment. The chief symptoms are those due to low-grade infection of the mandible. The necrosis of the mandible differs from phosphorus poisoning and ordinary osteomyelitis only in the number of areas involved and the remote location of the areas from one another.

As so few cases have been found among the three or four thousand girls who are working, he feels that a superimposed infection is necessary to produce the necrosis.

B. C. Cushway, M.D.

A Case of Antral Sinusitis Complicated by Radium Poisoning. Frederick B. Flinn. Laryngoscope, May, 1927, p. 341.

Radio-activity in the living cell.—A brief discussion of the importance of radio-activity in the metabolism of the living cell.

E. A. Pohle, M.D.

The Influence of Radio-activity on the Sugar Metabolism in the Living Cell. Julius Stoklasa. Strahlentherapie, 1927, XXV, 304.

Cholecystography.—Of 662 patients examined by cholecystography, 40 had cholecystectomy; 10 seen in private practice were added. The evidence of the cholecystogram in these 50 cases was compared with the pathologic changes found in the gall bladder. The pathologic conditions observed at the operating table were added from the surgeon's notes. The microscopic findings were tabulated. Stones were found at operation in 23 patients; in 8 (34.8 per cent) these were visualized by the roentgenologist; in 7 the gall bladder was visualized, 5 showed negative stone shadows, and 2 positive stone shadows. In 1, the gall bladder was not visualized but the stones were. In 3, the gall bladder was visualized but not the stones; in 1, overlying gas bubbles evidently occluded the stones. In 11, neither the gall bladder nor the stones were seen. In 30 to whom the dye was ad-

ministered intravenously, 11 showed normal concentration of the dye. In these 11, microscopic examination revealed cholecystitis; Grade 1 in three; Grade 2 in one; Grade 3 in five, and Grade 4 in three. In 18 with oral administration, 10 showed normal concentration. Cholecystitis was found in 9 of these; Grade 1 in three; Grade 2 in one, and Grade 3 in five. The gall bladder was not visible in 19—14 intravenous and 5 oral administration. Fifteen showed moderate to severe cholecystitis, with partial or complete destruction of the mucosa. Four showed little or no destruction of the mucosa, one of these had stones, one omental adhesions, one duodenal adhesions and another adhesions to the duodenum and colon. The latter two had enlargement of the glands. In all cases with incomplete concentration the findings were those of definite pathology. In 5 failures to empty after the fatty meal, 3 showed adhesions and 2 stones. Of 31 gall-bladder shadows, 3 were noted to be irregular in outline; the surgeon noted a few adhesions in 1, scar tissue in the wall of 1, and a thickened fibrous wall in another.

C. G. Sutherland, M.B. (Tor.)

Cholecystography and Pathologic Changes in the Gall Bladder. L. R. Chandler and R. R. Newell. Jour. Am. Med. Assn., May 14, 1927, p. 1550.

Bone changes.—Bone is modified in disease, like other connective tissue substances. One sees at autopsy the pathological change of bone in general diseases. The chief changes are degeneration, thrombosis, and progressive tissue changes. In typhoid fever, in pneumonia, in tuberculosis and in all infections and intoxications degenerative and progressive tissue changes are noted.

In Hodgkin's disease various general pathological processes are seen in bone, none of which are outside of the realm of inflammation. All of them, when grouped, make us think of chronic inflammation. The changes of the granulous group are closest to those seen in Hodgkin's disease. They resemble a chronic infection, akin to tuberculosis. The bone matrix and marrow are both affected. Two cases are presented in detail showing different degrees of bone involvement of the ribs, femurs, and vertebræ. A detailed microscopic study of the bones involved is given.

Le Roy Sante, M.D.

Bone in Hodgkin's Disease. Sydney M. Cone. Jour. Bone and Joint Surg., July, 1927, p. 458.

Quality of roentgen rays.—The question how to define the quality of roentgen rays in therapy has been decided by the valuable work of the authors of this paper. They conclude that the measuring of the half value layer in copper is the method of choice. It seems necessary, however, to indicate the filter used in each case because the degree of homogeneity has a great influence upon the interpretation of the results of measurements. Their table giving the minimum filter thickness for practically homogeneous radiation and the corresponding half value layers in copper is reprinted here.

Kilovolt	Homogeneity	H.V.L.
70	1.0 mm. Al.	0.05
80	2.5 mm. Al.	0.085
90	approx. 4.0 mm. Al.	0.135
125	" 0.25 mm. Cu.	0.36
150	0.5 mm. Cu.	0.6
175	0.75 mm. Cu.	0.9
200	0.9 mm. Cu.	1.2

E. A. Pohle, M.D.

The Measuring of the Quality of Roentgen Rays in Deep Therapy. H. Holthusen and H. Gollwitzer. Strahlentherapie, 1927, XXVI, 101.

Mucous colitis.—Mucous colitis is located in the colon and yet it is primarily not a disease of the colon but of the nervous system. Tubular casts of the bowel may be passed by rectum and yet the tenacious mucus separated from the colon without a lesion of the lining membrane. Osler described the condition as "a secretion neurosis of the large intestine,

met with particularly in nervous and hysterical patients."

The roentgenological sign is the "string sign." Characteristic pain beneath the left costal arch or in the left groin, or in the mid-abdomen where it involves the transverse colon, should suggest it. In the author's series the descending colon was involved in the majority of cases. The string-like distribution of the barium on the second day, usually in the descending colon from the splenic flexure to the sigmoid, occasionally also in the sigmoid, is pathognomonic.

C. G. SUTHERLAND, M.B. (TOR.)

A Roentgenological Sign of Mucous Colitis. A. W. Crane. Am. Jour. Roentgenol. and Rad. Ther., April, 1927, p. 416.

Fracture of the frontal sinus.—Trauma to the nose particularly produces fractures which may and do extend into the frontal sinus. The patient whose case is reported is a man, aged 32, who was injured June 26, 1926, in a somewhat curious manner. While engaged in a miniature battle, using "corn on cob" as implements of warfare, he was hit in the left temple by a corn cob. Instead of the blow resulting in a swelling it left a hole about half an inch deep. Patient became very dizzy and developed a severe headache. He was then taken to a hospital. The doctors who examined him seemed much puzzled at the condition. X-ray examination was made but the patient was told there was nothing wrong. Headaches and dizziness persisted for over a week. Ten days after the accident the family physician referred the case to the writer. External examination revealed marked depression over the left frontal sinus area, about one-half inch below the surface. Intranasal examination revealed marked turgescence of the entire left naris, with some mucopus in the middle fossa. Transillumination fairly good. X-ray examination showed fracture of the outer table of the left frontal sinus, with slight clouding. Left naris was cleansed thoroughly and the area around the frontal duct opening adrenalized and cocainized, followed by gentle suction. The patient was kept under observation and treatment for a week. Treatment consisted of adrenalin spray and argyrol tampons at home, with cleansing, suction, and baking at the office. The patient has been perfectly well since that time. The depression seems to be filling in gradually, as evidenced by improved appearance and X-ray films taken in October, 1926.

B. C. CUSHWAY, M.D.

Fracture of the Outer Table of the Frontal Sinus. Simon Stein. Laryngoscope, May, 1927, p. 355.

Ureteral reflux.—Many articles have appeared in the last few years calling attention to the condition of ureteral reflux, or backflow of the bladder urine into the ureters to the kidney pelves. The conclusions of the report are based on the use of this principle of ureteral backflow to obtain pyelograms in patients that were not possible otherwise; also for treatment of bladder and kidney conditions.

In one patient the filling of the bladder with sixteen ounces of sterile water prevented the fluid from draining into the bladder too rapidly. In this way the pyelogram was possible and not without the filling of the bladder. The cause of the reflux may be too much distention of the bladder in irrigations.

F. B. SHELDON, M.D.

Ureteral Reflux. James R. Dillon. Calif. and Western Med., January, 1927, p. 72.

Lipiodol in neurological localization.—The technic used by the writers is to place the patient in the lateral or sitting position and prepare for cistern puncture. Two or three cubic centimeters of spinal fluid are removed and an equal amount of warmed lipiodol is injected into the cistern. The patient is now placed in the sitting position with the head

slightly bent forward. The neck is gently percussed over the site of the injection or the head moved forward and backward and laterally a few times. This also aids the descent of the lipiodol. With no blockage, the patient in the sitting position, the lipiodol soon collects in the lumbosacral cul-de-sac. Not only can the level of the block be located, but in many cases the size and shape of the tumor can be delineated.

Among the conclusions are: (1) Lipiodol should be used as an aid only in localizing or in confirming a spinal cord block. (2) Mistakes may easily be made in interpreting lipiodol X-ray films if the position of the patient is not noted at the time of taking the films. The author reports six cases, in which lipiodol was used.

F. B. SHELDON, M.D.

On the Value of Lipiodol as an Aid in Neurologic Localization: A Report Based on Six Cases. Julian M. Wolfsohn and Edmund J. Morrissey. Calif. and Western Med., January, 1927, p. 55.

Iodized oil in eustachian tube.—This is a preliminary report on a technic for visualizing the eustachian tube by the use of iodized oil. The roentgenographic technic is detailed by the roentgenologist and the results of the experiment are given. Strictures or stones can be distinctly visualized and located. Only in patients with dilated tubes or in whom atrophic changes have occurred in the lining epithelium is the iodized oil retained for more than a few minutes.

C. G. SUTHERLAND, M.B. (TOR.)

Visualization of the Eustachian Tube by the Roentgen Ray: Preliminary Report. William Spielberg. Archiv. Otolaryngol., April, 1927, p. 334.

Latent time after roentgen-ray exposure.—The biological effect of roentgen rays on blood vessels does not manifest itself immediately, but there is a certain latent time, the duration of which depends upon several factors. Changes in the shape and behavior of blood vessels during the exposure to radiation, reported by Sakussow, have induced the authors to study this problem with a pharmacodynamic method on the isolated ears of rabbits, the tongues and webs of frogs, the ears of rabbits and white mice, and the nail-beds of man microscopically. They found that no changes during irradiation could be observed in the isolated ears of rabbits. Only prolonged exposure of from two to three hours changed the tonus. The experiments on the other objects turned out to be negative. As to the capillaries of the nail-bed in man, they found that the latent time amounted to at least several hours. It is concluded that these observations do not confirm the assumption that the nervous apparatus of the blood vessel walls represents the point of attack of the primary X-ray effect.

E. A. POHLE, M.D.

Regarding the Change of the Functional Stage of the Blood Vessels after X-ray Exposure. Third Communication: On the Question of the So-called Latency of the X-ray Effect. N. W. Lazarew and A. Lazarewa. Strahlentherapie, 1927, XXV, 458.

Radiotherapy in laryngeal tuberculosis.—In the X-ray Laboratory of the Surgical Clinic, University of Leipzig, 24 cases of tuberculosis of the larynx have been treated during the period 1924-26. Eleven of the patients could be followed up and their histories are related in detail. Based on these observations, it is recommended to irradiate all "productive" (fibrous) forms of laryngeal tuberculosis, with moderate doses, *i.e.*, one-third to one-half E.D. effective in the lesion. Radiation of short wave length seems to be preferable; 180 K.V., 0.5 Zn. plus 3.0 Al., 25 to 30 cm. F.S.D., 30 per cent E.D. to each side of the neck. In seven cases a definite improvement followed the treatment. It is worth while, therefore, to give it a trial. Regarding the exudative forms of laryngeal tuberculosis, great care must be taken in selecting suitable

cases for roentgenotherapy. It appears that the necrotic process is hastened by irradiation.

E. A. POHLE, M.D.

The Roentgen-ray Treatment of Tuberculosis of the Larynx. L. Goldstein. Strahlentherapie, 1927, XXV, 402.

Cholesterin in dosimetry.—Based on the experiments of Roffo, the authors investigated the effect of roentgen rays on cholesterin. They found that this substance is destroyed only when dissolved in chloroform or carbon tetrachloride, and proved to be unsuitable for measuring X-ray energy independent from the wave length.

E. A. POHLE, M.D.

On the Question of Cholesterin Change after X-ray Irradiation in Vitro. A. Bachem and R. P. MacFate. Strahlentherapie, 1927, XXV, 476.

Tumors in childhood.—Fifty per cent of all intracranial tumors are practically excluded from the children's list. The three types of tumor in childhood that need particular concern are: (1) a large block of gliomas; (2) a small group of congenital tumors, and (3) a few tuberculomas. Starr classified his group: tuberculomas 152; gliomas 37; sarcomas 34; gliosarcomas 5; cysts 30; carcinomas 10; syphilomas 2, and no diagnosis 30.

C. G. SUTHERLAND, M.B. (TOR.)

The Intracranial Tumors of Pre-adolescence. Harvey Cushing. Am. Jour. Dis. Child., April, 1927, p. 551.

Radiotherapy of papilloma of the larynx.—Surgical procedure in cases of papilloma of the larynx does not seem to be very satisfactory. The author has, therefore, studied the effect of roentgen rays on this growth in man. He reports seven cases which were observed up to three years. Four patients had been treated before without success; one, five times during two years. Roentgen rays cured all but one; the latter, however, showed marked decrease in the size of the lesion. As technic, the following is proposed: 180 K.V., 0.5 Zn. plus 1.0 Al., 23 cm. F.S.D., 50 per cent E.D. (6 H) per field, 6 × 8 cm. left and right neck, 2 to 5 series, with intervals of six weeks and more.

E. A. POHLE, M.D.

Regarding the Roentgenotherapy of Papilloma of the Larynx. M. Gruschetzkaja. Strahlentherapie, 1927, XXV, 420.

X-ray therapy of lichen ruber planus.—Following the suggestion of Pautrier, the authors treated eight cases of lichen ruber planus by exposing the spinal cord and the sympathetic ganglia corresponding to the site of the lesion. The upper and lower parts of the cord were irradiated (28 to 30 cm. spark gap, 3 to 4 Al., 25 to 30 F.S.D., 3 to 6 H per field). Further study of the efficacy of this procedure is recommended.

E. A. POHLE, M.D.

Regarding the Treatment of Lichen Ruber Planus by Roentgen-ray Exposure of the Spinal Cord and Sympathetic Ganglia. S. Neumark and A. Krynski. Strahlentherapie, 1927, XXV, 427.

X-ray necrosis of the mandible.—A patient who was operated on in July, 1920, for carcinoma of the lower lip, received during the following year 7 E.D. through 0.5 Zn. over the mandible. Epilation followed and two years later a slight induration of the skin could be noticed. In February, 1926, the left side of the face became swollen; for three days the patient had a high temperature, then an abscess opened spontaneously in the mandibular region. Roentgen-ray examination-revealed a process in the mandible very similar to osteomyelitis. In the absence of any other explanation, a clinical diagnosis of a late roentgen-ray necrosis was made. As a practical conclusion, the author emphasizes not to give

more than 100 per cent E.D. in a single dose and 300 to 400 per cent E.D. as a total dose, with six months' interval, to adult bone.

E. A. POHLE, M.D.

Late Necrosis of the Mandible Following Roentgenotherapy. H. Rahm. Strahlentherapie, 1927, XXV, 338.

Fracture table.—A portable fracture table bearing a frame upon which the patient may be extended and upon which the limb can be put under traction is described. The apparatus can be put on a fluoroscopic table and the anteroposterior position viewed directly by fluoroscopic screen. For the lateral view one must depend on lateral radiography from a tube stand.

LE ROY SANTE, M.D.

A New Fracture Table to be Used in Conjunction with the Fluoroscope. J. O. Rankin. Jour. Bone and Joint Surg., July, 1927, p. 447.

The alimentary tract.—In six thousand autopsies at the Great Ormond Street Hospital since 1900, there have been eight cases of congenital atresia of the alimentary tract. Congenital narrowing, without obliteration, was found in six cases. The sites of constriction were: in atresia, esophagus 6; duodenum 6; small intestine 13, and large intestine 3; in partial stenosis, esophagus 2; duodenum 2; small intestine 0, and large intestine 2.

C. G. SUTHERLAND, M.B. (TOR.)

Congenital Atresia of the Alimentary Tract. W. P. H. Sheldon. Arch. Dis. Child., October, 1926, p. 279.

Suprarenal sarcomas.—Robert Hutchison (*Quarterly Journal of Medicine*, 1907) reviewed the suprarenal sarcomas in children, with metastasis to the skull. He reported 10 cases. In the majority of cases the first thing noticed was some swelling about the bones of the skull: following this, or sometimes before, proptosis of one or both eyes. Discoloration of the eyelids on one or both sides was observed in two-thirds of the cases. Anemia was a striking feature. An abdominal tumor was palpable in one or other loin in 5 cases. The progress of the disease is rapid; the duration of life averages from six months to a year.

C. G. SUTHERLAND, M.B. (TOR.)

Neurocytoma of the Left Suprarenal Gland with Metastasis to the Liver, Skull, and Bones. Charles N. Sturtevant and Thomas C. Kelly. Am. Jour. Dis. Child., April, 1927, p. 590.

Sarcoma in an irradiated tuberculous joint.—A girl, aged 23, was treated seven years ago over the right elbow for joint tuberculosis. Following a fall and fracture of the right upper arm directly above the joint, the arm swelled and became very painful. The roentgenogram showed a few suspicious spots in the humerus, and operation, followed by biopsy, established the diagnosis of sarcoma. The author discusses the possibility of a relation between roentgen-ray treatment of the elbow and the development of the sarcoma. No histological diagnosis of tuberculosis had been made.

E. A. POHLE, M.D.

Development of Sarcoma Following Roentgenotherapy of Joint Tuberculosis. M. Baumann. Strahlentherapie, 1927, XXV, 373.